UNIVERSITÀ
DEGLI STUDI DI TRIESTE
Dipartimento di Scienze della Vita

Ramkhamhaeng
University

Dryades

# 100 Lichens from Thailand: a tutorial for students

**Pier Luigi Nimis, André Aptroot, Kansri Boonpragob, Kawinnat Buaruang, Vasun Poengsungnoen, Wetchasart Polyiam, Kajohnsak Vongshewarat, Sanya Meesim, Chaiwat Boonpeng, Supattara Phokaeo, Muthita Molsil, Phimpha Nirongbutr, Ek Sangvichien, Andrea Moro, Elena Pittao, Stefano Martellos**

**Images by various authors**
**Curator of the image archive: Andrea Moro**

EUT

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**EUT - Edizioni Università di Trieste**


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# Contents

# Introduction

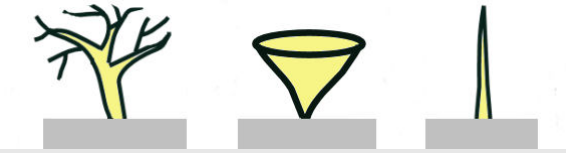
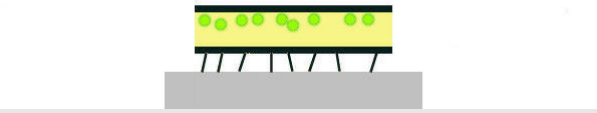
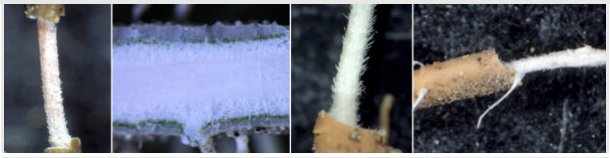
This is the printable version of an interactive identification tool for 100 species of lichens commonly occurring in Thailand, prepared on the occasion of a workshop held in Bangkok in June 2017. Of course, this guide cannot be used to identify all lichens found in the Country, but it may be useful as a tutorial in workshops and courses for students and beginners, who will be asked to identify only the species which are included in the key. In this way, they will learn the basic terminology, and will make the first steps in lichen identification.

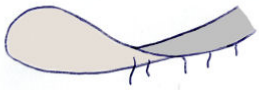
The dichotomous key is also available in stand-alone versions for mobile devices via the free app KeyToNature (Android and iOS). The key has been created using program FRIDA (Martellos 2010, Martellos & Nimis 2015) at the Department of Life Sciences of the University of Trieste (Italy), and will be further tested and implemented at the Department of Biology of the Ramkhamhaeng University, Bangkok, to encompass a broader set of species. The pictures of species were in part provided by the Lichen Herbarium of Ramkhamhaeng University, Department of Biology, Faculty of Science, Bangkok, and in part derive from other sources, especially the online site http://www.tropicallichens.net.

# Literature

Martellos S. (2010) - Multi-authored interactive identification keys: The FRIDA (FRiendly IDentificAtion) package - Taxon 59 (3): 922-929.
Martellos S. & P.L. Nimis (2015) - From Local Checklists to Online Identification Portals: A Case Study on Vascular Plants. - PlosONE, https://doi.org/10.1371/journal.pone.0120970

# Field guide

| | | | |
|---|---|---|---|
| **1** | Thallus fruticose or foliose |  | **2** |
| **1** | Thallus squamulose, crustose or leprose |  | **53** |
| **2** | Thallus fruticose |  | **3** |
| **2** | Thallus foliose |  | **11** |
| **3** | Thallus with a central, compact medullary thread visible by stretching the branches |  | **4** |
| **3** | Thallus without a compact medullary thread | | **6** |
| **4** | Thallus without red pigments |  | ***Usnea pectinata*** Taylor |
| **4** | Thallus with red pigments (in medulla or cortex) |  | **5** |
| **5** | Central axis compact. Red pigment located in cortex |  | ***Usnea rubicunda*** Stirt. |
| **5** | Central axis a hollow tube. Red pigment located in a ring between cortex and central axis |  | ***Usnea baileyi*** (Stirt.) Zahlbr. |

| | | | |
|---|---|---|---|
| **6** | Lichens with a primary, squamulose thallus and hollow podetia |  | **7** |
| **6** | Lichens without a primary thallus, with thin, flattened lobes |  | **8** |
| **7** | Podetia simple or with a few branches, not shrub-like, the surface uneven. Apothecia and pycnidia scarlet red |  | ***Cladonia homchantarae*** Ahti & Parnmen |
| **7** | Podetia much branched, shrub-like, smooth and glossy. Apothecia and pycnidia brown |  | ***Cladia aggregata*** (Sw.) Nyl. |
| **8** | Lower surface white |  | **9** |
| **8** | Lower surface dark |  | **10** |
| **9** | Marginal cilia dark. Apothecia very rare |  | ***Leucodermia leucomelos*** (L.) Kalb |
| **9** | Marginal cilia white, numerous. Apothecia common |  | ***Heterodermia comosa*** (Eschw.) Follmann & Redón |

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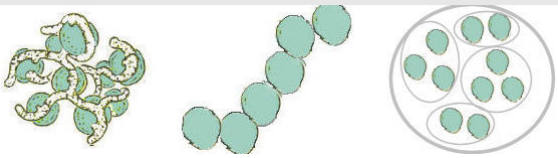
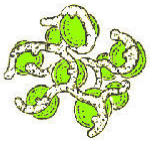
|---|---|---|---|
| **10** | Thallus without isidia |  | ***Hypotrachyna nepalensis*** (Taylor) Divakar |
| **10** | Thallus with isidia |  | ***Hypotrachyna vexans*** (Zahlbr. ex W.L. Culb. & C.F. Culb.) Divakar, A. Crespo, Sipman, Elix & Lumbsch |
| **11** | Photobiont a cyanobacterium (algal layer blue-green in section) |  | **12** |
| **11** | Photobiont a green alga (algal layer bright green in section) |  | **17** |
| **12** | Thallus heteromerous, with a well-developed medulla, not gelatinous when wet |  | **13** |
| **12** | Thallus homoiomerous, without medulla, more or less gelatinous when wet |  | **14** |
| **13** | Thallus without soredia, usually with apothecia |  | ***Coccocarpia erythroxyli*** (Spreng.) Swinscow & Krog |
| **13** | Thallus with marginal soredia, without apothecia |  | ***Erioderma sorediatum*** D.J. Galloway & P.M. Jørg. |

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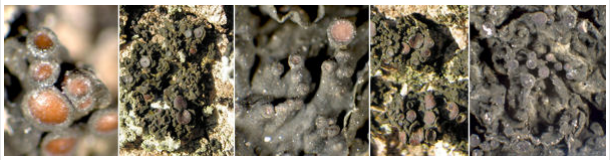
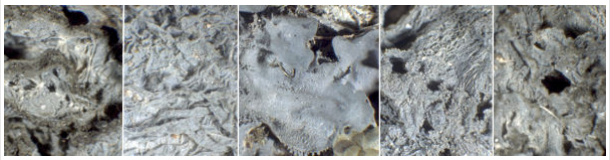
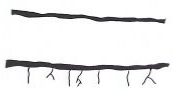
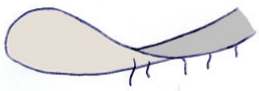
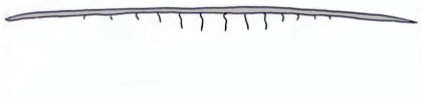
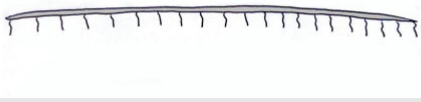
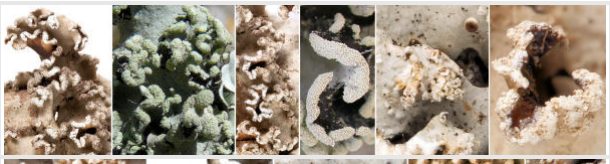
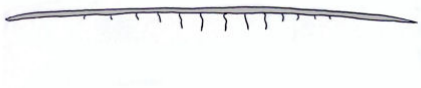
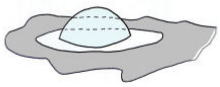
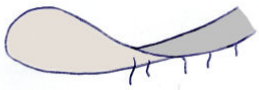
|---|---|---|---|
| **14** | Thallus dark grey to black when dry. Upper cortex totally absent. Ascospores simple or transversely septate |  | **15** |
| **14** | Thallus blue-grey when dry. Upper cortex present, formed by a single layer of cells, Ascospores submuriform |  | **16** |
| **15** | Thallus soft and gelatinous when wet, crisp and fragile when dry. Ascospores 6−8-celled |  | ***Collema coilocarpum*** (Müll. Arg.) Zahlbr. |
| **15** | Thallus tough, cartilaginous also when wet. Ascospores 1-celled |  | ***Physma byrsaeum*** (Ach.) Tuck. |
| **16** | Thallus smooth, without isidia |  | ***Leptogium azureum*** (Ach.) Mont. |
| **16** | Thallus wrinkled, with flattened isidia (phyllidia) |  | ***Leptogium marginellum*** (Sw.) Gray |
| **17** | Thallus without soredia or isidia |  | **18** |
| **17** | Thallus with soredia or isidia |  | **26** |

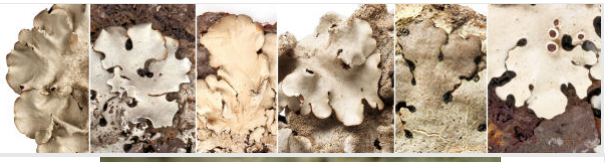
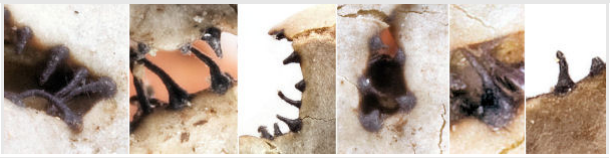
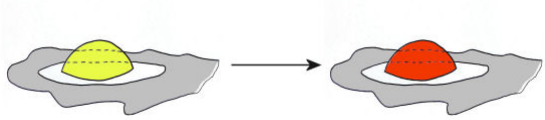
| | | | |
|---|---|---|---|
| **18** | Lobes ascending for much of their length (thallus subfruticose) |  | **19** |
| **18** | Lobes adpressed to the substrate, or ascending only at margins |  | **20** |
| **19** | Thallus without cilia. Lower surface dark |  | ***Hypotrachyna nepalensis*** (Taylor) Divakar |
| **19** | Thallus with abundant cilia. Lower surface pale |  | ***Heterodermia comosa*** (Eschw.) Follmann & Redón |
| **20** | Rhizines absent |  | ***Dirinaria confluens*** (Fr.) D.D. Awasthi |
| **20** | Rhizines present |  | **21** |
| **21** | Lower surface pale (white to tan) |  | **22** |
| **21** | Lower surface dark (black to dark brown) |  | **23** |

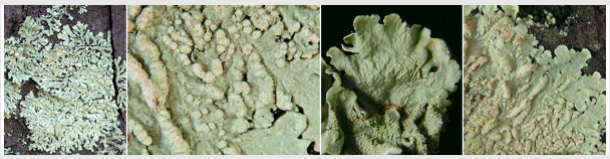
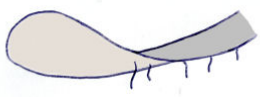
| | | | |
|---|---|---|---|
| **22** | Lower surface pale brown. Medulla KC+ pink. Ascospores colourless, 1-celled |  | ***Relicinopsis intertexta*** (Mont. & Bosch) Elix & Verdon |
| **22** | Lower surface white in centre, yellow at margins. Medulla KC−. Ascospores brown, 2-celled |  | ***Heterodermia flabellata*** (Fée) D.D. Awasthi |
| **23** | Rhizines present in the centre, but absent or poorly developed in a broad marginal band |  | **24** |
| **23** | Rhizines abundant also at the margins of lobes |  | **25** |
| **24** | Medulla K+ dirty brown, P+ deep orange, with protocetraric acid |  | ***Parmotrema overeemii*** (Zahlbr.) Elix |
| **24** | Medulla K−, P+ red, with alectoronic and α-collatolic acids |  | ***Parmotrema maclayanum*** (Müll. Arg.) Hale |
| **25** | Upper surface K−, UV+ yellow, with pseudocyphellae. Medulla yellow. Spores brown, 2-celled |  | ***Pyxine berteriana*** (Fée) Imshaug |
| **25** | Upper surface K+ yellow, UV−, without pseudocyphellae. Medulla whitish. Spores hyaline, 1-celled |  | ***Remototrachyna kingii*** (Hale) Divakar & A. Crespo |

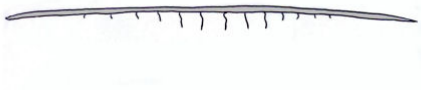
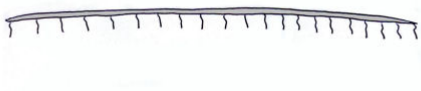
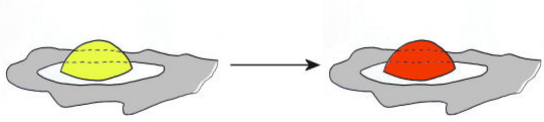
| | | | |
|---|---|---|---|
| **26** | Thallus with soredia |  | **27** |
| **26** | Thallus with isidia or phyllidia |  | **39** |
| **27** | Lobes ascending for much of their length (thallus subfruticose) |  | ***Leucodermia leucomelos*** (L.) Kalb |
| **27** | Lobes adpressed to the substrate, or ascending only at margins |  | **28** |
| **28** | Rhizines absent |  | **29** |
| **28** | Rhizines present |  | **30** |
| **29** | Upper surface K+ yellow, P+ yellow, with atranorin, medulla UV+ white |  | ***Dirinaria picta*** (Sw.) Schaer. ex Clem. |
| **29** | Upper surface K−, P−, medulla UV− |  | ***Hyperphyscia adglutinata*** (Flörke) H. Mayrhofer & Poelt |
| **30** | Rhizines present in the centre, but absent or poorly developed in a broad marginal band |  | **31** |

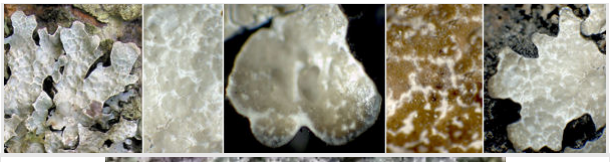
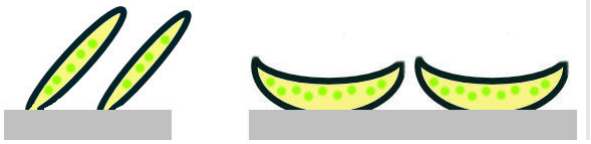
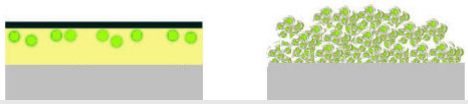
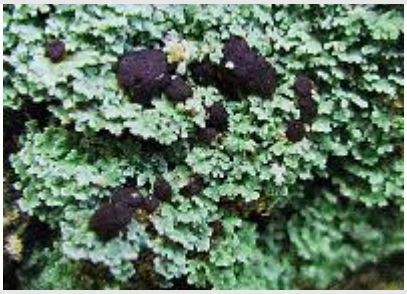
| | | | |
|---|---|---|---|
| **30** | Rhizines abundant also at the margins of lobes |  | **33** |
| **31** | Medulla K+ yellow turning deep red, with salazinic acid |  | ***Parmotrema cristiferum*** (Taylor) Hale |
| **31** | Medulla K−, without salazinic acid |  | **32** |
| **32** | Medulla P+ red, with protocetraric acid |  | ***Parmotrema gardneri*** (C.W. Dodge) Sérus. |
| **32** | Medulla P−, without protocetraric acid |  | ***Parmotrema praesorediosum*** (Nyl.) Hale |
| **33** | Lower surface dark (black to dark brown) |  | **34** |
| **33** | Lower surface pale |  | **36** |
| **34** | Thallus with red pigments in soralia and pseudocyphellae |  | ***Pyxine coccifera*** (Fée) Nyl. |

| | | | |
|---|---|---|---|
| **34** | Thallus without red pigments | | **35** |
| **35** | Dactyls present. Upper surface K+ yellow, P+ yellow. Medulla K+ yellow turning red, P+ orange, UV- |  | ***Pyxine retirugella*** Nyl. |
| **35** | Dactyls absent. Upper surface and medulla K−, P−, UV+ yellow |  | ***Pyxine cocoës*** (Sw.) Nyl. |
| **36** | Soralia laminal or marginal, not labriform |  | **37** |
| **36** | Soralia terminal, labriform (lip-shaped) |  | **38** |
| **37** | Soralia laminal, rounded |  | ***Physcia poncinsii*** Hue |
| **37** | Soralia marginal, elongated |  | ***Physcia undulata*** Moberg |
| **38** | Lower surface with yellow to orange patches reacting K+ red |  | ***Heterodermia obscurata*** (Nyl.) Trevis. |

| | | | |
|---|---|---|---|
| **38** | Lower surface white |  | ***Heterodermia speciosa*** (Wulfen) Trevis. |
| **39** | Lobes ascending for much of their length (thallus subfruticose) |  | ***Hypotrachyna vexans*** (Zahlbr. ex W.L. Culb. & C.F. Culb.) Divakar, A. Crespo, Sipman, Elix & Lumbsch |
| **39** | Lobes adpressed to the substrate, or ascending only at margins |  | **40** |
| **40** | Rhizines absent |  | ***Dirinaria aegialita*** (Ach.) B.J. Moore |
| **40** | Rhizines present |  | **41** |
| **41** | Margin of lobes with distinctly bulbate cilia |  | **42** |
| **41** | Margin of lobes without cilia or with simple cilia |  | **44** |
| **42** | Medulla K−, P−, without lichen substances |  | ***Bulbothrix queenslandica*** (Elix & G.N. Stevens) Elix |
| **42** | Medulla K+ yellow then red, P+ orange, with salazinic acid |  | **43** |

| | | | |
|---|---|---|---|
| **43** | Lower surface brown |  | ***Bulbothrix isidiza*** (Nyl.) Hale |
| **43** | Lower surface black, at least in the center |  | ***Bulbothrix tabacina*** (Mont. & Bosch) Hale |
| **44** | Upper surface yellowish green, K− (with usnic acid) |  | **45** |
| **44** | Upper surface white to grey, K+ yellow |  | **46** |
| **45** | Medulla KC + yellow, P−, with barbatic acid |  | ***Relicinopsis rahengensis*** (Vain.) Elix & Verdon |
| **45** | Medulla KC−, P+ orange, with protocetraric acid |  | ***Relicinopsis malaccensis*** (Nyl.) Elix & Verdon |
| **46** | Lower surface pale (white to tan) |  | **47** |
| **46** | Lower surface dark (black to dark brown) |  | **48** |

| | | | |
|---|---|---|---|
| **47** | Lower surface ecorticate |  | ***Polyblastidium microphyllum*** (Kurok.) Kalb |
| **47** | Lower surface corticate |  | ***Heterodermia lepidota*** Swinscow & Krog |
| **48** | Rhizines present in the centre, but absent or poorly developed in a broad marginal band |  | **49** |
| **48** | Rhizines abundant also at the margins of lobes |  | **50** |
| **49** | Medulla C−, P+ brick red, with protocetraric acid |  | ***Parmotrema saccatilobum*** (Taylor) Hale |
| **49** | Medulla C+ red, P−, with lecanoric acid |  | ***Parmotrema tinctorum*** (Despr. ex Nyl.) Hale |
| **50** | Medulla K− |  | ***Canoparmelia owariensis*** (Asahina) Elix |
| **50** | Medulla K+ yellow turning to red |  | **51** |

| | | | |
|---|---|---|---|
| **51** | Upper surface without pseudocyphellae, P− (salazinic acid) |  | ***Parmelinella wallichiana*** (Taylor) Elix & Hale |
| **51** | Upper surface with pseudocyphellae, P+ yellow-orange (norstictic acid) |  | **52** |
| **52** | Thallus with finally erumpent-sorediate dactyls |  | ***Pyxine retirugella*** Nyl. |
| **52** | Thallus with cylindrical isidia |  | ***Pyxine cylindrica*** Kashiw. |
| **53** | Thallus squamulose |  | **54** |
| **53** | Thallus crustose or leprose |  | **55** |
| **54** | Thallus without soredia. Ascocarps perithecia (opening through a pore) |  | ***Endocarpon pallidum*** Ach. |
| **54** | Thallus with marginal soralia. Ascocarps apothecia (hymenium exposed) |  | ***Phyllopsora soralifera*** Timdal |

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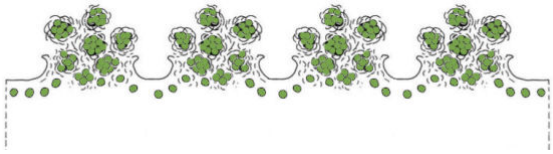
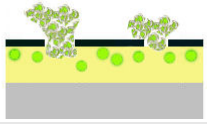
|---|---|---|---|
| **55** | Thallus with soredia, usually without ascocarps |  | **56** |
| **55** | Thallus without soredia, usually with ascocarps |  | **59** |
| **56** | Thallus corticate, with well-delimited soralia |  | **57** |
| **56** | Thallus not corticate, subleprose, consisting of a mass of soredia-like granules |  | **58** |
| **57** | Thallus greenish, not lobed, K+ yellow |  | ***Lecanora helva*** Stizenb. |
| **57** | Thallus grey to pale brown, lobed, K− |  | ***Hyperphyscia adglutinata*** (Flörke) H. Mayrhofer & Poelt |
| **58** | Thallus blue-grey |  | ***Crocynia pyxinoides*** Nyl. |
| **58** | Thallus bright yellow |  | ***Chrysothrix xanthina*** (Vain.) Kalb |

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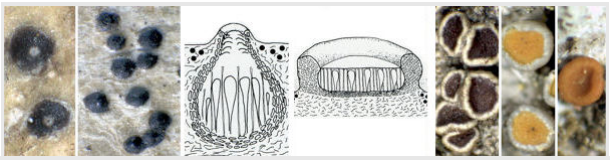
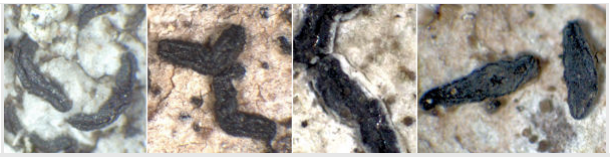
| **59** | Ascocarps lirelliform (much longer than wide) |  | **60** |
| **59** | Ascocarps not lirelliform (more or less isodiametric) |  | **71** |
| **60** | Ascocarps white-pruinose, the pruina C+ red |  | ***Dyplolabia afzelii*** (Ach.) A. Massal. |
| **60** | Ascocarps not pruinose, or if pruinose C− | | **61** |
| **61** | Ascocarps embedded into distinct stromata |  | **62** |
| **61** | Ascocarps not embedded into stromata |  | **65** |
| **62** | Excipulum not carbonised |  | ***Phaeographis intricans*** (Nyl.) Staiger |
| **62** | Excipulum carbonised (black in section) |  | **63** |
| **63** | Ascospores hyaline. Disc brown-pruinose |  | ***Glyphis cicatricosa*** Ach. |

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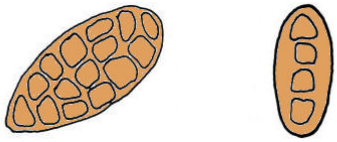
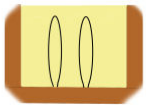
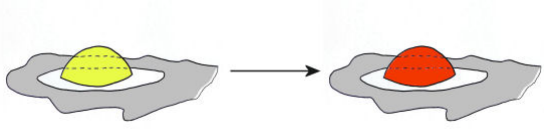
|---|---|---|---|
| **63** | Ascospores brown. Disc epruinose or white-pruinose |  | **64** |
| **64** | Thallus K+ yellow, P−. Disc epruinose. Ascospores 4-celled, with transversal septa only |  | ***Sarcographa labyrinthica*** (Ach.) Müll. Arg. |
| **64** | Thallus K+ red, P+ yellow. Disc white-pruinose. Ascospores with 5-7 transversal septa and 1 longitudinal septum |  | ***Sarcographa glyphiza*** (Nyl.) Kr.R. Singh & G.P. Sinha |
| **65** | Excipulum laterally carbonised (black in section) |  | **66** |
| **65** | Excipulum not carbonised |  | **68** |
| **66** | Thallus K−. Ascocarps 0.7−1.0 mm wide. Ascospores pale brown, 1 per ascus |  | ***Platygramme pudica*** (Mont. & Bosch) M. Nakan. & Kashiw. |
| **66** | Thallus K+ yellow turning to red, with norstictic acid. Ascocarps 0.15−0.5 mm wide. Ascospores hyaline, 6-8 per ascus |  | **67** |
| **67** | Ascospores with both transversal and longitudinal septa (more or less muriform) |  | ***Graphis analoga*** Nyl. |

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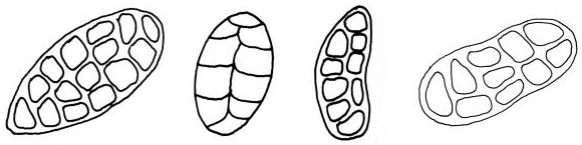
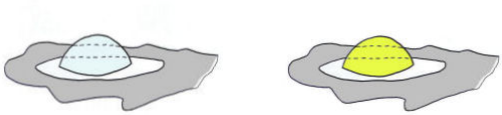
|---|---|---|---|
| **67** | Ascospores with transversal septa only |  | ***Graphis streimannii*** A.W. Archer |
| **68** | Ascospores 4-celled, with transversal septa only |  | ***Phaeographis brasiliensis*** (A. Massal.) Kalb & Matthes-Leicht |
| **68** | Ascospores with both transversal and longitudinal septa (more or less muriform) |  | **69** |
| **69** | Thallus K+ yellow, then red, with norstictic acid. Ascospores 1 per ascus |  | ***Diorygma junghuhnii*** (Mont. & Bosch) Kalb, Staiger & Elix |
| **69** | Thallus K− or K+ persistently yellow, without norstictic acid. Ascospores 8 per ascus |  | **70** |
| **70** | Disc not exposed. Thallus K+ bright yellow, with stictic acid. Ascospores 50−75 × 9−12(−18) µm |  | ***Pallidogramme chrysenteron*** **(**Mont.) Staiger, Kalb & Lücking |
| **70** | Disc exposed. Thallus K−. Ascospores 23−35 × 10−13 µm |  | ***Phaeographis caesioradians*** (Leight.) A.W. Archer |

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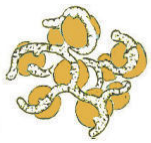
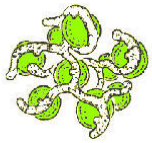
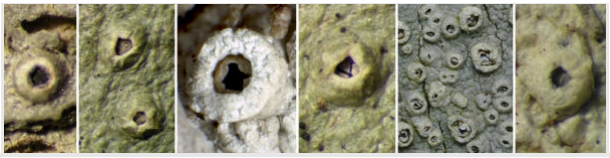
|---|---|---|---|
| **71** | Ascocarps apothecioid (hymenium exposed) |  | **72** |
| **71** | Ascocarps perithecioid (opening through a pore) |  | **88** |
| **72** | Photobiont trentepohlioid (algal cells more or less orange) |  | **73** |
| **72** | Photobiont trebouxioid (algal cells bright green) |  | **77** |
| **73** | Apothecia not immersed in thalline warts |  | **74** |
| **73** | Apothecia immersed in thalline warts |  | **75** |
| **74** | Ascospores muriform. Disc brown-pruinose |  | ***Glyphis scyphulifera*** (Ach.) Staiger |
| **74** | Ascospores with transversal septa only. Disc of young apothecia yellow-pruinose |  | ***Cresponea proximata*** (Nyl.) Egea & Torrente |
| **75** | Ascospores hyaline, with transversal septa only. Thallus P+ orange-red, with protocetraric acid |  | ***Ocellularia perforata*** (Leight.) Müll. Arg. |

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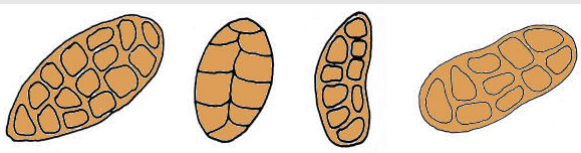
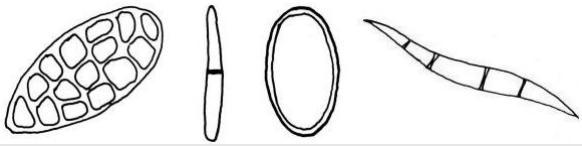
| **75** | Ascospores finally brown and often submuriform. Thallus P− or P+ yellow |  | **76** |
| **76** | Thallus K+ yellow, then orange-red, P−, with norstictic acid. Ascospores 20−35(−40) × 10−17 µm |  | ***Leucodecton occultum*** (Eschw.) Frisch |
| **76** | Thallus K+ persistently yellowish, P+ yellow, with psoromic acid. Ascospores 8−20(−22) × 6−10(−12) µm |  | ***Stegobolus fissus*** (Müll. Arg.) Frisch |
| **77** | Ascospores brown |  | **78** |
| **77** | Ascospores hyaline |  | **82** |
| **78** | Apothecia lecanorine (with photobionts in the margin) |  | **79** |
| **78** | Apothecia non lecanorine (without photobionts in the margin) |  | **80** |
| **79** | Thallus K+ yellow, with atranorin, medulla KC−. Ascospores >15 µm long |  | ***Rinodina oxydata*** (A. Massal.) A. Massal. |

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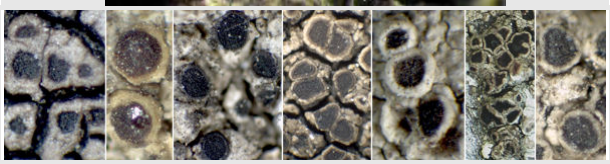
| **79** | Thallus K−, medulla KC+ red, with gyrophoric acid. Ascospores <15 µm long |  | ***Dimelaena tenuis*** (Müll. Arg.) H. Mayrhofer & Wippel |
| **80** | Thallus warted to granular, with red pigments in granules |  | ***Gassicurtia omiae*** Kalb |
| **80** | Thallus without red pigments | | **81** |
| **81** | Thallus K+ yellow, then orange-red, P+ yellow-orange, with norstictic acid. Ascospores >15 µm long |  | ***Buellia curatellae*** Malme |
| **81** | Thallus K+ persistently yellow, P−. Ascospores 10-14 µm long |  | ***Amandinea diorista*** (Nyl.) Marbach **var. *hypopelidna*** (Stirt.) Marbach |
| **82** | Ascocarps not yellow to red |  | **83** |
| **82** | Ascocarps at least in part (margin, disc) bright yellow, orange or red |  | **85** |
| **83** | Apothecia lecideine. Spores transversely septate. Thallus K− |  | ***Bacidia medialis*** (Tuck.) Zahlbr. |

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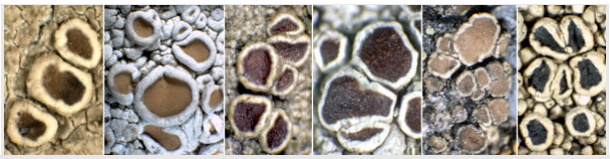
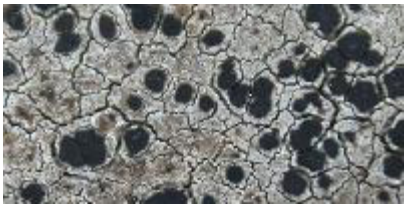
| **83** | Apothecia lecanorine. Spores simple. Thallus K+ yellow |  | **84** |
| **84** | Apothecia immersed, aspicilioid. Disc dark brown |  | ***Lecanora subimmersa*** Müll. Arg. |
| **84** | Apothecia not immersed, not aspicilioid. Disc pale brown |  | ***Lecanora helva*** Stizenb. |
| **85** | Apothecia lecanorine (with photobionts in the margin) |  | ***Haematomma rufidulum*** (Fée) A. Massal. |
| **85** | Apothecia non lecanorine (without photobionts in the margin) |  | **86** |
| **86** | Disc bright red. Ascospores 1-celled |  | ***Ramboldia russula*** (Ach.) Kalb, Lumbsch & Elix |
| **86** | Disc reddish brown. Ascospores more than 1-celled |  | **87** |
| **87** | Ascospores finally submuriform, 25−60 × 11−20 µm |  | ***Letrouitia transgressa*** (Malme) Hafellner & Bellem. |

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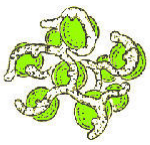
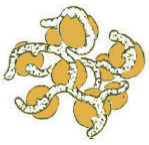
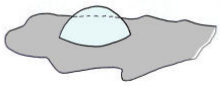
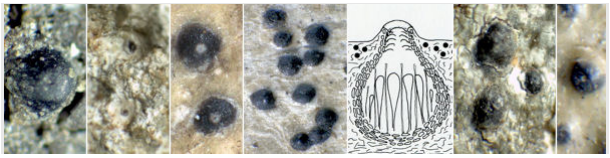
| **87** | Ascospores with transversal septa only, 21−29(−35) × 6.5−9(−10) µm |  | ***Letrouitia domingensis*** (Pers.) Hafellner & Bellem. |
| **88** | Photobiont trebouxioid (algal cells bright green) |  | **89** |
| **88** | Photobiont trentepohlioid (algal cells more or less orange) |  | **91** |
| **89** | Thallus C+ red, with lecanoric acid. Ascospores brown, muriform |  | ***Diploschistes actinostomus*** (Ach.) Zahlbr. |
| **89** | Thallus C−. Ascospores hyaline, 1-celled |  | **90** |
| **90** | Thallus P+ yellow to orange. Ascopores 4 per ascus |  | ***Pertusaria leioplaca*** DC. |
| **90** | Thallus P−. Ascospores 2 per ascus |  | ***Pertusaria cicatricosa*** Müll. Arg. |
| **91** | Ascocarps apothecia immersed in thalline warts (the disc is visible from above) |  | **92** |
| **91** | Ascocarps true perithecia (opening through a small pore) |  | **93** |

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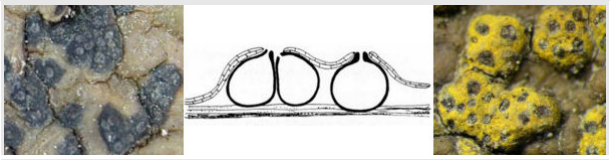
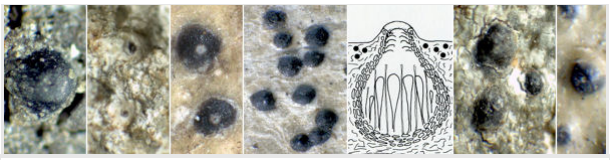
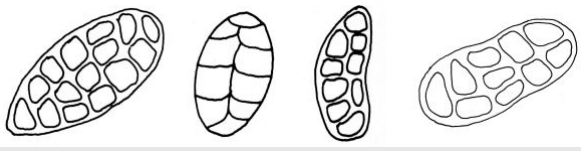
|---|---|---|---|
| **92** | Thallus K+ orange-red, P−, with norstictic acid. Ascospores brown |  | ***Leucodecton occultum*** (Eschw.) Frisch |
| **92** | thallus K+ yellowish brown, P+ orange-red, with protocetraric acid. Ascospores hyaline |  | ***Ocellularia perforata*** (Leight.) Müll. Arg. |
| **93** | Perithecia aggregated into pseudostromata |  | **94** |
| **93** | Perithecia not aggregated into pseudostromata |  | **102** |
| **94** | Thallus or medulla without yellow-orange pigments |  | **95** |
| **94** | Thallus or medulla with yellow-orange pigments |  | **97** |
| **95** | Ascospores brown, 4-celled |  | ***Pyrenula anomala*** (Ach.) Vain. |
| **95** | Ascospores hyaline, muriform |  | **96** |
| **96** | Ascospores 4 per ascus, 140−220 × 30−75 µm |  | ***Astrothelium megaspermum*** (Mont.) Aptroot & Lücking |

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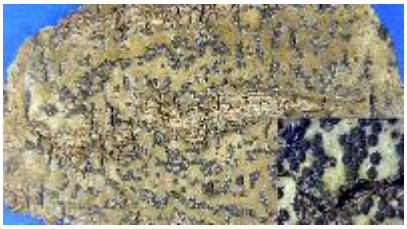
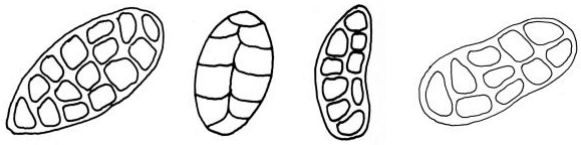
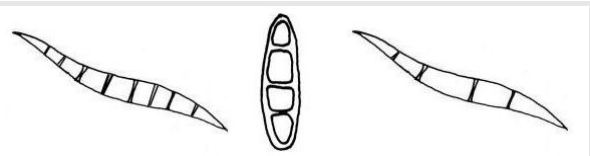
| **96** | Ascospores 8 per ascus, 35−50 × 12−18 µm |  | ***Astrothelium subdiscretum*** (Nyl.) Aptroot & Lücking |
| **97** | Ascospores with both transversal and longitudinal septa (more or less muriform) |  | **98** |
| **97** | Ascospores with transversal septa only |  | **100** |
| **98** | Yellow-orange pigments present at the surface of pseudostromata |  | ***Marcelaria benguelensis*** (Müll. Arg.) Aptroot, Nelsen & Parnmen |
| **98** | Yellow-orange pigments present only inside the pseudostromata |  | **99** |
| **99** | Ascospores 120−220 × 25−40 µm, constricted at the markedly thickened median septum |  | ***Astrothelium meristosporum*** (Mont. & Bosch) Aptroot & Lücking |
| **99** | Ascospores 40−55 × 11−17 µm, the central septum not thickened |  | ***Bathelium madreporiforme*** (Eschw.) Trevis. |
| **100** | Ascospores 4-celled |  | ***Astrothelium macrocarpum*** (Fée) Aptroot & Lücking |

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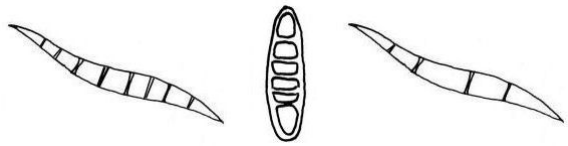
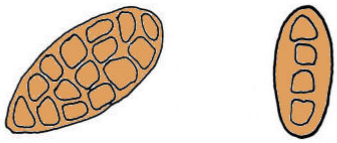
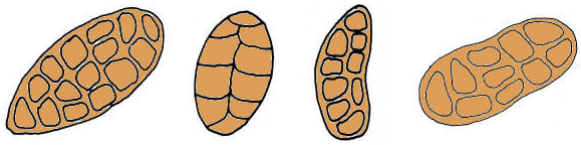
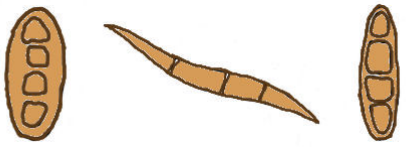
|---|---|---|---|
| **100** | Ascospores more than 4-celled |  | **101** |
| **101** | Yellow-orange pigments present on the surface of pseudostromata |  | ***Trypethelium eluteriae*** Spreng. |
| **101** | Yellow-orange pigments present only inside the pseudostromata |  | ***Bathelium nigroporum*** (Makhija & Patw.) Aptroot & Lücking |
| **102** | Ascospores hyaline |  | **103** |
| **102** | Ascospores brown |  | **104** |
| **103** | Thallus ecorticate. Ascospores 25−33 µm long |  | ***Polymeridium catapastum*** (Nyl.) R.C. Harris |
| **103** | Thallus corticate. Ascospores 20−25 µm long |  | ***Nigrovothelium tropicum*** (Ach.) Lücking, M.P. Nelsen & Aptroot |
| **104** | Ascospores with both transversal and longitudinal septa (more or less muriform) |  | **105** |
| **104** | Ascospores with transversal septa only |  | **107** |

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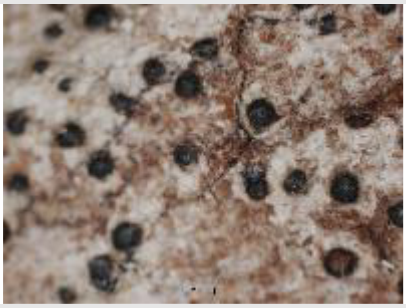
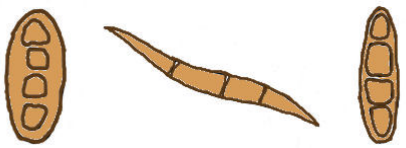
| **105** | Ascospores 2-4 per ascus, 120−160 × 30−45 µm |  | ***Anthracothecium macrosporum*** (Hepp) Müll. Arg. |
| **105** | Ascospores 8 per ascus, much smaller | | **106** |
| **106** | Ascospores fusiform. Thallus with pseudocyphellae |  | ***Pyrenula breutelii*** (Müll. Arg.) Aptroot |
| **106** | Ascospores globose. Thallus without pseudocyphellae |  | ***Sulcopyrenula subglobosa*** (Riddle) Aptroot |
| **107** | Ascospores 8-celled |  | ***Porina mastoidea*** (Ach.) Müll. Arg. |
| **107** | Ascospores 4-celled |  | **108** |
| **108** | Pseudocyphellae present. Ascospores 32−45 × 15−27 µm |  | ***Pyrenula immissa*** (Stirt.) Zahlbr. |
| **108** | Pseudocyphellae absent. Ascospores much smaller | | **109** |

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| **109** | Perithecia in dense groups. Ascospores 15−21 × 6−8 µm | |  | ***Pyrenula anomala*** (Ach.) Vain. |
| **109** | Perithecia solitary. Ascospores 12−15 × 4−6 µm | |  | ***Pyrenula aspistea*** (Ach.) Ach. |

# Notes on species

***Amandinea diorista*** (Nyl.) Marbach **var. *hypopelidna*** (Stirt.) Marbach - Thallus crustose, 1−3 cm wide, yellow-green, esorediate. Apothecia 0.3−0.4 mm wide, lecideine, immersed to adnate; disc black, weakly to strongly convex, epruinose; proper margin excluded. Epihymenium dark brown to olive-brown, K−; hypothecium pale to dark brown. Paraphyses with brown or dark brown caps. Ascospores olive-green to olive-brown, 8 per ascus, *Buellia*-type, 2-celled, ellipsoidal, 10−14 × 4.5−5.5 µm; torus absent; outer spore wall moderately to strongly ornamented. Photobiont: chlorococcoid. Chemistry: thallus K+ yellow, C−, KC−, P−, UV+ orange; with arthothelin (major) and thuringione (major).

***Anthracothecium macrosporum*** (Hepp) Müll. Arg. - Thallus crustose, brownish to dark green, without pseudocyphellae. Perithecia solitary, conical, not distinctly flattened, erumpent from the substratum, laterally covered by the thallus, 1.0−2.5 mm diam., to 2 mm tall. Perithecial wall with a distinct clypeus, to 500 µm thick; ostiole whitish, obconical, apical. Ascospores muriform, brownish, 2−4 per ascus, elongate-fusiform, with rounded ends, 120−160 × 30−45 µm. Photobiont: trentepohlioid. Chemistry: all spot tests negative.

***Astrothelium macrocarpum*** (Fée) Aptroot & Lücking - Thallus crustose, corticate, olive-green to yellowish, smooth to somewhat uneven. Ascomata astrothelioid, several chambers joined with eccentric, fused ostioles; joined ascomata pseudostromatic. Pseudostromata 0.1−1 mm diam, raised, more or less conical with a flattened top, the lateral part whitish, the upper part with a yellow-orange pigment and a dark ostiole. Hamathecium not inspersed. Ascospores hyaline, 8 per ascus, fusiform-ellipsoid, 4-celled, 21−28 × 7−11 µm. Photobiont: trentepohlioid. Chemistry: thallus UV+ yellow, K−, C−, P−, with lichexanthone; pseudostromata K+ purple, UV+ red, with anthraquinones. Syn.: *Astrothelium galbineum* Kremp.

***Astrothelium megaspermum*** (Mont.) Aptroot & Lücking - Thallus crustose, corticate, olive-green, smooth to uneven. Ascomata trypethelioid perithecia, with apical ostioles, solitary, 0.8−1.5 mm diam., prominent, hemispherical with flattened top, covered by thallus except for the dark ostiolar area, which is sometimes surrounded by a whitish rim. Hamathecium inspersed. Ascospores generally 4 per ascus, hyaline, densely muriform, oblong-fusiform, 140−220 × 30−75 µm, without distinctly thickened median septum, I−. Photobiont: trentepohlioid. Chemistry: all spot tests negative. Syn.: *Laurera megasperma* (Mont.) Riddle

***Astrothelium meristosporum*** (Mont. & Bosch) Aptroot & Lücking - Thallus crustose, corticate, light olive-green, uneven to verrucose. Ascomata trypethelioid, with apical ostioles, 1−1.5 mm diam., prominent, hemispherical with a flattened top, covered by thallus except the whitish to greyish ostiolar area, 0.7−2 mm diam. Hamathecium hyaline or slightly yellowish, inspersed. Ascospores (4−)8 per ascus, hyaline, muriform, oblong-fusiform, 120−220 × 25−40 µm, constricted at the markedly thickened median septum, I−. Photobiont: trentepohlioid. Chemistry: thallus UV−, K−, C−, P−; pseudostromata internally K+ red, with anthraquinones. Syn.: *Laurera meristospora* (Mont. & Bosch) Zahlbr.

***Astrothelium subdiscretum*** (Nyl.) Aptroot & Lücking - Thallus crustose, corticate, olive-green to brownish, uneven to verrucose-rugulose. Ascomata trypethelioid perithecia, with apical ostioles; pseudostromata 0.8−1.5(−2.0) mm broad, immersed-erumpent, irregular to linear and often confluent and reticulate, with ascomata exposed and black. Hamathecium inspersed, clear. Ascospores 8 per ascus, hyaline, small muriform, ellipsoid, 35−50 × 12−18 µm, without a distinctly thickened median septum, I−. Photobiont: trentepohlioid. Chemistry: all spot tests negative. Syn.: *Laurera subdiscreta* (Nyl.) Zahlbr.

***Bacidia medialis*** (Tuck.) Zahlbr. - Thallus crustose, continuous to rimose-areolate, sometimes consisting of granular areoles, grey-green to green-brown. Apothecia lecideine, at first flat, then often convex; disc pale yellow to pale pink, sometimes orange-brown or red-brown, epruinose; margin concolorous with disc, fairly persistent but usually finally excluded. Epithecium and hypothecium colourless to pale brown-orange. Ascospores hyaline, 8 per ascus, 4- or occasionally to 8-celled, bacilliform to clavate, 16−40 × 1.9−3.7 µm. Pycnidia immersed in thallus, colourless; conidia filiform, straight or slightly curved, non-septate, 13−17 × 0.8−1 µm. Photobiont: chlorococcoid. Chemistry: all spot tests negative.

***Bathelium madreporiforme*** (Eschw.) Trevis. - Thallus crustose, corticated, olive-green to yellowish brown, smooth to uneven. Ascomata trypethelioid, 0.7−1 mm diam., with apical ostioles, immersed in a dark pseudostroma. Pseudostromata 1−2 mm broad, prominent to sessile, blackish brown, internally with a yellow-orange, granular pigment. Hamathecium not inspersed. Ascospores hyaline, 8 per ascus, muriform, fusiform-ellipsoid, 40−55 × 11−17 µm, the central septum not thickened. Photobiont: trentepohlioid. Chemistry: thallus UV−, K−, C−, P−; pseudostromata internally K+ red, with anthraquinones.

***Bathelium nigroporum*** (Makhija & Patw.) Aptroot & Lücking - Thallus crustose, corticate, olive green to yellowish green, smooth to uneven. Ascomata trypethelioid, with apical ostioles, solitary to irregularly confluent, 0.7−1 mm diam., prominent to sessile, blackish brown, internally with orange-brown granular pigments. Hamathecium not inspersed. Ascospores 8 per ascus, hyaline, transversely septate, 6−10-celled, fusiform, 30−40 × 6−9 µm, I−. Photobiont: trentepohlioid. Chemistry: thallus K−, C−, P−, UV−. Ascomata UV−, internally K+ red, with anthraquinones.

***Buellia curatellae*** Malme - Thallus crustose, 1−4 cm wide, thin, membranous, finely rimose to areolate, whitish to grey or pale yellow-brown, weakly to markedly verrucose; prothallus black or not apparent. Apothecia, 0.1−0.7 mm wide, lecideine, moderately immersed to sessile; disc black, epruinose, plane to convex; margin black, thick, narrow, or excluded in old, convex apothecia. Proper exciple brown-black, with or without a paler inner part. Epihymenium olive-brown to blackish green, K+ clear yellow-green, olive or K−. Hymenium inspersed with oil droplets. Hypothecium greenish black to dark olive-brown. Ascospores brown, 8 per ascus, 2-celled, 15−22 × 6−8 µm, with weak to moderately strong subapical wall thickenings; outer wall smooth or weakly ornamented. Photobiont: chlorococcoid. Chemistry: thallus K+ yellow, then red, C−, P+ yellow to yellow-orange; with norstictic acid (major).

***Bulbothrix isidiza*** (Nyl.) Hale - Thallus foliose, adnate, 4−10 cm in diam., irregularly lobate; lobes sublinear to subirregular, plane to subconvex, separate, 1.5−5 mm wide, with prominent inflated, bulbate cilia. Upper surface pale grey, shiny, faintly or distinctly white maculate. Isidia laminal, dense, cylindrical, simple to coralloid. Medulla white. Lower surface pale brown, the rhizines, pale to medium brown, simple to branched. Apothecia, rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Pycnidia common, immersed; conidia bacilliform to weakly bifusiform, 5−6 × 1 µm. Photobiont: chlorococcoid. Chemistry: upper cortex K+ yellow, C−, KC−, P+ yellow, with atranorin; medulla K+ yellow turning deep red, C−, KC−, P+ orange, with salazinic and consalazinic acids.

***Bulbothrix queenslandica*** (Elix & G.N. Stevens) Elix - Thallus foliose. Lobes sublinear to linear laciniate, grey to grey-green, more or less dichotomously branched, 0.5−1.1(−1.4) mm wide, slightly imbricate, adnate and adpressed, with truncate to subtruncate apices, the margins flat, slightly sinuous to crenate or irregular, incised, the axils oval to irregular. Laminal ciliar bulbs usually abundant. Maculae weak to distinct, punctiform, laminal, more evident at distal parts. Cilia black or brown, simple to trifurcate, with bulbate bases, abundant along the margins. Isidia scarce to frequent, usually grouped at some parts, laminal, granular to smooth cylindrical, simple to almost coralloid, ciliate. Medulla white. Lower cortex black, shiny, pale brown at margin,

rhizinate. Rhizines initially simple, soon turning dichotomously branched, with bulbate bases. Apothecia rare, lecanorine. Ascospores hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, KC−, P−, with atranorin and chloroatranorin; no medullary substances.

***Bulbothrix tabacina*** (Mont. & Bosch) Hale - Thallus foliose, adnate, to 4−7 cm wide. Lobes subirregular to sublinear, 1.5−5 mm wide; margins with moderately dense bulbate cilia. Upper surface pale grey, flat, shiny, maculate, continuous; isidia sparse, mostly simple, less than 0.5 mm high. Medulla white. Lower surface shiny, black, with a narrow, pale brown, papillate or naked zone along margins; rhizines mostly simple, black. Apothecia rare, lecanorine. Ascospores hyaline, simple. Photobiont: chlorococcoid. Chemisty: cortex K+ yellow, C−, P−; medulla K+ yellow then red, C−, P+ orange; with atranorin, chloroatranorin, salazinic acid (major) and consalazinic acid.

***Canoparmelia owariensis*** (Asahina) Elix - Thallus foliose, tightly attached, 2−5 cm across. Lobes sublinear to irregular, 0.5−3 mm wide, the apices truncate. Upper surface whitish grey, smooth, becoming rugulose, pustulate-isidiate. Isidia coarse and short, rarely bursting open apically becoming coarsely sorediate. Medulla white. Lower surface black, brown at margins, rhizinate. Rhizines sparse, black, simple. Apothecia rare, lecanorine. Ascospores hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, P−; medulla K−, C−, KC−, P−; with chloroatranorin, atranorin, divaricatic acid, and nordivaricatic acid.

***Chrysothrix xanthina*** (Vain.) Kalb - Thallus crustose-leprose, thin, bright yellow to greenish yellow, unstratified, consisting of granules usually coalescing into patches; granules spherical to more or less irregular, 25−40 µm across. Apothecia very rare, arthonioid, yellow-pruinose, c. 0.1−0.2 mm across. Ascospores hyaline, 8 per ascus, 4-celled, 10.5−12 × 2.5−3 µm. Photobiont: chlorococcoid. Chemistry: spot tests negative, UV−; with pinastric acid.

***Cladia aggregata*** (Sw.) Nyl. - Thallus fruticose, consisting of pseudopodetia which are 1−8 cm tall, hollow, fragile when dry, greenish through shades of cream to almost black. Sterile pseudopodetia horny, rigid when dry, extremely variable in size, 0.5−8 mm wide, dichotomously or irregularly branched, flexuose, prostrate to ascending. Fertile pseudopodetia much thicker and taller, usually more perforate and more branched towards apex. Apothecia solitary or tiered, to 0.3 mm wide, lecideine; disc slightly concave to flat, dull, brownish black to black. Ascospores hyaline, 8 per ascus, simple, 12−15 × 4−5 µm. Pycnidia ellipsoidal; conidia c. 5 × 1 µm. Photobiont: chlorococcoid. Chemistry: thallus K−, C−, KC−, P−, with barbatic, 4-O-demethylbarbatic, fumarprotocetraric, and ursolic acids.

***Cladonia homchantarae*** Ahti & Parnmen - Primary thallus soon evanescent, consisting of green to brownish, laciniate squamules to 2.5 mm long. Podetia 3−7 cm tall, 1−1.5 mm thick, brownish-green, the necrotic bases blackening, unbranched to slightly branched, the tips subulate or with very narrow (1−2.5 mm) scyphi. Surface of podetia usually with a discontinuous, cracky, whitish-grey cortex, densely squamulose throughout, the squamules 0.7−2.5 mm wide, laciniate. Pycnidia frequent, at tips of podetia, pyriform, containing a red slime; conidia 6−8 × 1 µm, falciform. Apothecia frequent, lecideine, with red, 0.5−3 mm wide, often corymbose discs. Ascospores hyaline, 8 per ascus, 6−12 × 2.5−3 µm. Photobiont: chlorococcoid. Chemistry: podetia K+ yellow, C−, KC−, P+ yellow; with thamnolic acid (major) and didymic acid (major).

***Coccocarpia erythroxyli*** (Spreng.) Swinscow & Krog - Thallus foliose, heteromerous, more or less orbicular, 2−8(−15) cm wide, adnate, lobate. Lobes flabellate or cuneate, 1−3(−7) mm wide, contiguous to separated, lobulate (especially in older parts); apices rounded and deflexed, broader than interior parts of the lobes. Upper surface light to dark bluish grey when dry, darker when wet, smooth, usually glossy, sometimes with concentric, curved ridges; lacking isidia, but often with small accessory lobules in central parts. Medulla white or pale yellow. Lower surface usually pale brown, rarely black, rhizinate; rhizines white to black. Apothecia usually present, lecideine,

laminal, 1−4(−9) mm wide, orbicular; margin thin, only visible in young apothecia; disc reddish brown to black, flat to convex. Ascospores 8 per ascus, hyaline, simple, 7−14 × 3−5 µm. Pycnidia laminal or marginal, the ostiole dark. Conidia bacilliform, 2−4 × 1 µm. Photobiont: cyanobacterial. Chemistry: all spot tests negative.

***Collema coilocarpum*** (Müll. Arg.) Zahlbr. - Thallus foliose, mainly corticolous, homoiomerous, pulpy and swollen when wet, irregularly spreading, mostly dark olive green but often partly pale and membranous, becoming purplish grey blue when dry, rugose and fenestrate, the margins strongly ascending. Isidia absent, but often the thallus develops erect, thickened lobules or cylindrical outgrowths that may resemble isidia. Apothecia common and abundant, adjoined in clumps and lines on the ridges, lecanorine, the discs orange brown. Ascospores 8 per ascus, hyaline, narrowly spindle-shaped, 6−8-celled. Photobiont: cyanobacterial. Chemistry: all spot tests negative.

***Cresponea proximata*** (Nyl.) Egea & Torrente - Thallus crustose, continuous to rimose, grey to grey-white. Apothecia lecideine, black, to 1.7 mm diam.; margin persistent, disc concave, plane or undulate; excipulum cupulate, opaque dark brown to blackish; paraphyses numerous, simple to sparingly branched, with apices colourless or pale yellow-brown to grey-brown. Hypothecium brownish. Asci narrowly cylindrical. Ascospores 8 per ascus, hyaline, fusiform with rounded apices, 5−7(−8)-septate, 25−38(−40) × 5−7(−7.5) µm. Photobiont: trentepohlioid. Chemistry: all spot tests negative.

***Crocynia pyxinoides*** Nyl. - Thallus crustose, subleprose, poorly defined on a black prothallus, thick, cottony, bluish grey, lobed. Lobes distinct, adnate, ecorticate, 0.4−1.3 mm wide. Apothecia very rare, usually lacking. Photobiont: trentepohlioid. Chemistry: thallus K+ yellow, KC−, C−, P+ orange, with atranorin and stictic acid.

***Dimelaena tenuis*** (Müll. Arg.) H. Mayrhofer & Wippel - Thallus epilithic, crustose, thin, areolate, with elongate, often paler radiating lobes. Upper surface grey to dark brown, smooth and glossy. Apothecia 0.1−0.4 mm wide, adnate, initially lecanorine, becoming lecideine with age; disc black, plane to weakly convex; thalline exciple concolorous with the thallus, poorly developed and often excluded, black and carbonaceous. Epihymenium dark brown, K−, N−; hypothecium colourless to pale brown. Paraphyses with swollen, dark brown apical cells. Ascospores 8 per ascus, brown, 2-celled, broadly ellipsoidal, 9−14 × 4.5−8.0 µm. Pycnidia globose; conidia 5−8 × 1 µm. Photobiont: chlorococcoid. Chemistry: thallus K−, C−, P−; medulla K−, C+ red, KC+ red, P−; with 5-O-methylhiascic acid (major), gyrophoric acid (minor), lecanoric acid (minor).

***Diorygma junghuhnii*** (Mont. & Bosch) Kalb, Staiger & Elix - Thallus crustose, pale greyish white, thick, smooth, dull. Lirellae small, sometimes crowded, initially immersed, becoming sessile, with a conspicuous, raised thalline margin, straight, curved or sinuous, rarely branched, 1−4 × 0.2−0.5 mm; lips initially closed, opening to expose a white-pruinose disc. Proper exciple lacking. Hymenium I+ pale blue. Ascospores 1 per ascus, hyaline, densely muriform, (70−)78−105 × 20−35 µm, I+ blue. Chemistry: thallus K+ first yellow, then orange-red, C−, P−, with norstictic acid.

***Diploschistes actinostomus*** (Ach.) Zahlbr. - Thallus crustose, epilithic, rimose-areolate, well delimited; areoles 0.5−1.5 mm diam., plane, whitish grey to grey, smooth. Ascomata perithecioid apothecia, immersed in the areolae, up to 2 mm diam., opening through a small black pore. Ascospores 4−8 per ascus, brown, muriform, ellipsoid, 16−32 × 10−20 µm. Pycnidia immersed; conidia bacilliform, 4−7 × 1.0 µm. Photobiont: chlorococcoid. Chemistry: thallus K−, C+ red, KC−, P−, UV−, with lecanoric acid (major), diploschistesic and orsellinic acids (both minor).

***Dirinaria aegialita*** (Ach.) B.J. Moore - Thallus foliose, loosely appressed, up to 12 cm in diam., pinnately lobate; lobes radiating, confluent, usually concave towards the tips, 0.2−3 mm wide. Upper surface grey to whitish. Polysidiangia present, developing from isidia-like outgrowths, bursting open and revealing soredia, finally apically crateriform. Pseudocyphellae distinct, laminal and marginal, usually in the peripheral parts of lobes. Medulla white, the lowest part often orange, especially towards the lobe tips. Lower surface black in center, paler towards lobe tips, erhizinate Apothecia rare, laminal, 0.5−1.5 mm wide; disc black, sometimes slightly greyish pruinose. Ascospores 8 per ascus, brown, 2-celled, ellipsoid, 16−22 × 7−9 µm. Pycnidia immersed in warts; conidia bacilliform, 4−5 × 0.8−1 µm. Photobiont: chlorococcoid. Chemistry: upper cortex K+ yellow, C−, KC−, P+ yellow; medulla upper and lower part K−, C−, KC−, P−; upper cortex with atranorin, medulla with divaricatic acid.

***Dirinaria confluens*** (Fr.) D.D. Awasthi - Thallus foliose, adpressed to adglutinated, 3−6(−10) cm in diam., pinnately lobate. Lobes radiating, confluent, flat or convex but sometimes concave towards the tips, 0.5−2.5 mm wide. Upper surface lead-grey to almost white, pruinose or not, without soralia, isidia or polysidiangia. Pseudocyphellae often distinct, marginal and laminal, usually restricted to the peripheral parts. Medulla white, the lowest part sometimes orange, especially towards the lobe tips. Lower surface black in center, paler towards lobe tips, erhizinate. Apothecia very common, laminal, 0.5−1 mm wide; disc jet black; ascospores 8 per ascus, brown, 2-celled, narrowly ellipsoid, 15−19 × 6−7 µm. Pycnidia immersed in warts; conidia bacilliform, 4−5 × 0.8−1.1 µm. Photobiont: chlorococcoid. Chemistry: upper cortex K+ yellow, C−, KC−, P+ yellow; medulla K−, C−, KC−, P−; upper cortex with atranorin; medulla with divaricatic acid.

***Dirinaria picta*** (Sw.) Schaer. ex Clem. - Thallus foliose, appressed, 2−8 cm in diam., dichotomously lobate. Lobes radiating, confluent, flat to convex but sometimes concave near apex, 0.5−1 mm wide. Upper surface grey to almost white, shiny, not (or very faintly) pruinose, sorediate. Soredia farinose, in laminal, globose soralia. Pseudocyphellae present, but not distinct, mainly marginal. Medulla white, the lowest part seldom orange at the lobe tips. Lower surface black in center, paler towards lobe tips, erhizinate Apothecia very rare, laminal, 0.7−1.3 mm wide; disc jet-black, not pruinose. Ascospores 8 per ascus, brown, 2-celled, narrowly ellipsoid, 14−18 × 5.5−7.5 µm. Pycnidia immersed in warts; conidia bacilliform or fusiform, 3−4 × 0.9−1.1 µm. Photobiont: chlorococcoid. Chemistry: upper cortex K+ yellow, C−, KC−, P+ yellow; medulla K−, C−, KC−, P−; upper cortex with atranorin; medulla with divaricatic acid.

***Dyplolabia afzelii*** (Ach.) A. Massal. - Thallus crustose, thin, inconspicuous, almost entirely embedded in the substrate, of the same colour as the substrate or slightly darker, ochraceous, olive to deep brown; smooth, not pruinose. Lirellae prominent to sessile, elongate, broad; labia black, but entirely covered by a thick, white, C+ red pruina; disc concealed (a thin slit); exciple laterally strongly carbonised, more or less open below; hymenium hyaline, not inspersed, I−; ascospores 8 per ascus, hyaline, 4-celled, I−, narrowly ellipsoid to broadly fusiform, 16−22 × 7−10 µm. Photobiont: trentepohlioid. Chemistry: apothecial pruina C+ red; with lecanoric acid.

***Endocarpon pallidum*** Ach. - Thallus squamulose; squamules adjacent or slightly overlapping, 2−3 mm wide, adnate, the margins slightly elevated. Upper surface pale brown to beige, smooth, dull; lower surface whitish to pale brown, ecorticate, with hyaline rhizohyphae. Perithecia broadly pyriform to subglobose, to 0.3 mm wide, the apex concolorous with thallus or slightly darker; exciple brown to black; hymenial algal cells globose, 3−5 µm in diam. Ascospores 2 per ascus, hyaline to slightly brownish, muriform, broadly ellipsoid to elongate, 28−34 × 13−16/ 30−40 × 11−13 µm (proximal/distal spores). Pycnidia inconspicuous, small; conidia shortly bacilliform, 3−5 × <1 µm. Photobiont: chlorococcoid. Chemistry: all spot tests negative.

***Erioderma sorediatum*** D.J. Galloway & P.M. Jørg. - Thallus foliose, more or less loosely attached, broadly laciniately lobed. Lobes to 5 mm wide, with ascending margins, strongly

involute and crenate when dry, developing bluish, limbiform soralia on edges of upturned lower surface; soredia coarse, granular. Upper surface finely cobwebby-tomentose, often entangled in a loosely woven mat, greyish brown. Medulla white. Lower surface without apparent structures, white to pale cream; margins with blue-black, squarrose bundles of rhizohyphae. Apothecia and pycnidia unknown. Chemistry: thallus K−, C−, P+ yellow-orange, with eriodermin.

***Gassicurtia omiae*** Kalb - Thallus crustose, grey to greenish grey, strongly warted to granular, with red pigment in granules, delimited by a black prothallus. Apotecia lecideine, 0.6−0.8(−1.0) mm diam., sessile to moderately immersed; disc flat to slightly convex, grey- or grey-brown-pruinose; excipulum carbonaceous with a thin, external hyaline layer; epithecium golden grey, with granular epipsamma dissolving in K, hypothecium carbonaceous; hymenium not inspersed. Ascospores 8 per ascus, brown, 2-celled, with thin septa and moderately sculptured walls, 8−11 × 4.5−5.5 µm. Conidia clavate, 5.5−6.5 × 1−1.2 µm. Photobiont: chlorococcoid. Chemistry: K+ yellowish, C−, P−, UV+ blue-violet, with lobaric and chiodectonic acids.

***Glyphis cicatricosa*** Ach**.** - Thallus crustose, pale greenish fawn, thin, smooth, glossy. Lirellae numerous, open, initially rounded, becoming elongate and irregular in outline, finally richly branched, crowded, 0.1−0.2 mm wide, immersed in conspicuous, raised, white, 1.5−4.0 mm wide, black stromata with a thin white coating. Disc dark reddish brown, epruinose. Proper exciple completely carbonised and continuous in the stromata. Hypothecium black. Ascospores 8 per ascus, hyaline, transversely 8−12-celled, (32−)40−55 × 8−12 µm. Photobiont: trentepohlioid. Chemistry: all spot tests negative.

***Glyphis scyphulifera*** (Ach.) Staiger - Thallus thin, continuous to rimose, yellowish to pale creamy white, smooth, not pruinose. Ascocarps typically discoid, rarely broadly and shortly lirellate, reddish brown, dark brown or black, 0.3−0.5 mm diam., or to 0.7 mm long; margin thick; disc expanded, flattened to slightly concave, dark brown to black, but densely covered in a granular brown pruina; exciple completely carbonised; hymenium not inspersed, I+ weakly violet or pale greyish blue; ascospores 8 per ascus, hyaline to pale brownish with age, I+ bluish-violet, narrowly ellipsoid, 29−45 × 11−16 µm, muriform. Photobiont: trentepohlioid. Chemistry: all spot tests negative.

***Graphis analoga*** Nyl. - Thallus crustose, pale fawn, somewhat cracked, smooth, dull. Lirellae numerous, conspicuous, semi-immersed, with a thick thalline margin, simple, straight, curved or sinuous, rarely branched, 1−3 mm long, 0.15−0.3 mm wide; lips closed. Proper exciple laterally carbonised, largely concealed by the thalline margin. Hymenium not inspersed. Ascospores 6−8 per ascus, hyaline, submuriform to muriform, 22−35(−40) × 10−16 µm, I+ blue. Photobiont: trentepohlioid. Chemistry: thallus K+ first yellow, then orange-red, C−, P−, with norstictic acid (major) and connorstictic acid (minor).

***Graphis streimannii*** A.W. Archer - Thallus crustose, ash-white, thin, smooth, dull. Lirellae conspicuous, black, sessile, scattered, straight to curved, rarely branched, 1−4 mm long, (0.15−)0.25−0.50 mm wide, with a thalline margin; lips initially closed, opening to expose an epruinose to very lightly pruinose epihymenium. Exciple laterally carbonised. Hymenium inspersed. Ascospores 8 per ascus, hyaline, transversely (10−)12(−16)-celled, (35−)45−60(−70) × 6−8(−10) µm, I+ blue-violet. Photobiont: trentepohlioid. Chemistry: thallus K+ first yellow, then orange-red, C−, P−, with norstictic acid.

***Haematomma rufidulum*** (Fée) A. Massal. - Thallus pale to greenish grey, uneven, warty, cracked, without soredia and isidia. Apothecia lecanorine, sessile, 1−2 mm across, disc red, thalline margin wavy or crenulate. Epithecium K+ durable violet-red (russulone). Ascospores 8 per ascus, hyaline, transversely septate, 10−11(−20)-celled, straight or somewhat S-curved, 51−54(−63) × 4.5−5.5 µm. Photobiont: chlorococcoid. Chemistry: thallus K+ yellowish, C−, KC−, P−, UV−, with atranorin, placodiolic acid, and russulone in the apothecia.

***Heterodermia comosa*** (Eschw.) Follmann & Redón - Thallus foliose to subfruticose, usually forming small tufts of ascending lobes, up to 7 cm across. Lobes linear to paddle-shaped, rarely branched, suberect, partially imbricate, up to 5 mm wide, convex, ciliate. Cilia prominent, usually simple, marginal, whitish, up to 4 mm long. Upper surface white to greyish white, mostly with cilia if not densely covered by pycnidia. Lower surface white or variegated ochraceous, erhizinate. Upper cortex prosoplectenchymatous; medulla white; lower cortex absent. Apothecia common, lecanorine, terminal to subterminal, substipitate, 1−5(−10) mm diam., lobulate, ciliate; disc dark brown, densely pruinose. Ascospores 8 per ascus, brown, 2-celled, narrowly ellipsoid to fusiform, 31−34 × 13−15.5 µm. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow C−, KC−, P+ yellow; medulla K+ yellow, C−, KC−, P−; cortex with atranorin and chloroatranorin; medulla with atranorin, zeorin and an unknown ochraceous pigment.

***Heterodermia flabellata*** (Fée) D.D. Awasthi - Thallus foliose, greyish white, appressed to the substratum, irregularly lobed, without soredia and isidia. Lobes linear-elongate, minutely notched, 0.7~2.5 mm broad, smooth, somewhat pruinose at the end. Medulla white; lower cortex absent; lower surface white in the centre, deep yellow at the margins, with marginal, white to jet black, simple or squarrosely branched, 1−2 mm long rhizines. Apothecia lecanorine, rare. Ascospores 8 per ascus, brown, 2-celled. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, P−; medulla K+ yellow, C−, KC−, P−, or P+ pale yellow; pigmented undersurface K+ purple: with atranorin, zeorine, and unidentified yellow substance.

***Heterodermia lepidota*** Swinscow & Krog - Thallus foliose, orbicular to irregularly spreading, loosely adnate, forming extensive colonies to 20 cm wide. Lobes 0.7−2.5 mm wide, more or less plane, sublinear, with short lateral lobes; apices not ascending, eciliate. Upper surface whitish grey, phyllidiate; phyllidia marginal and laminal, simple to dissected, ecorticate on the lower surface. Medulla white. Lower surface corticate, white to pale brown near the centre. Rhizines pale or becoming dark towards the apices, simple to sparingly branched, mainly marginal. Apothecia rare, lecanorine, laminal, 0.5−2.0 mm wide; margin crenulate to phyllidiate; disc concave, brown to brown-black, epruinose. Ascospores 8 per ascus, brown, 2-celled, ellipsoidal, 24−33 × 12−17 µm. Pycnidia immersed; conidia bacilliform, 4−6 × 1 µm. Photobiont: chlorococcoid. Chemistry: cortex and medulla K+ yellow, C−, KC−, P+ yellow, with atranorin (major), and zeorin (major).

***Heterodermia obscurata*** (Nyl.) Trevis. - Thallus foliose, orbicular to irregularly spreading, loosely adnate, to 5 cm wide, but often coalescing into large colonies. Lobes 0.7−2.0 mm wide, c. 2−4 mm wide at the tips, plane to convex, sublinear-elongate, dichotomously to irregularly branched, radiating; apices not ascending, contiguous to discrete, with short lateral lobes, eciliate. Upper surface grey-white to greenish white, sorediate; soredia farinose to granular, in labriform soralia at the apices of lateral and terminal lobes. Upper medulla white; lower medulla dark yellow to orange-brown. Lower surface ecorticate, arachnoid, dark yellow to orange-brown. Rhizines marginal, black, simple or squarrosely branched, 1−2 mm long. Apothecia rare, lecanorine. Ascospores 8 per ascus, brown 2-celled. Pycnidia common, visible as black dots; conidia bacilliform, 4−5 × 1 µm. Chemistry: cortex K+ yellow, C−, KC−, P+ yellow; medulla K+ yellow, C−, P−; lower surface K+ violet; with atranorin (major), zeorin (major).

***Heterodermia speciosa*** (Wulfen) Trevis. - Thallus foliose, orbicular to irregular, adnate, 2−4 cm wide. Lobes 0.5−1.5 mm wide, plane to weakly convex, sublinear-elongate, often slightly broader towards the apices, dichotomously branched, radiating; apices not ascending, eciliate. Upper surface greyish white to grey; soredia greyish to blue-grey, forming labriform soralia at the tips of short lateral lobes. Medulla white. Lower surface corticate, whitish to pale brown. Rhizines sparse, pale to blackening. Apothecia very rare, lecanorine. Ascospores 8 per ascus, brown, 2-celled. Pycnidia immersed or slightly protruding; conidia bacilliform, 4−5 × 1 µm. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, KC−, P+ yellow; medulla K+ yellow, C−, P− or P+ pale yellow; with atranorin and zeorin (major).

***Hyperphyscia adglutinata*** (Flörke) H. Mayrhofer & Poelt - Thallus foliose to subcrustose, orbicular to irregular (adjacent thalli becoming confluent), less than 2 cm diam., very tightly adnate, densely lobate. Lobes 0.3−0.7(−1) mm wide, radiating, usually plane. Upper surface grey−brown to dark brown, sorediate. Soredia laminal, maculiform, often confluent in old thalli. Medulla white; lower surface blackish centrally, paler marginally, erhizinate. Apothecia very rare, lecanorine. Ascospores 8 per ascus, brown, 2-celled. Pycnidia: common, with black, weakly protruding tips; conidia filiform, 15−20 × 0.5−1 µm. Photobiont: chlorococcoid. Chemistry: cortex and medulla K− C−, KC−, P−.

***Hypotrachyna nepalensis*** (Taylor) Divakar - Thallus foliose to subfruticose, of subinvolute to flat, 1−2 mm wide, ascending lobes; upper surface pale grey, lacking vegetative propagules, edges of lobes turned down and tinged tan-brown, surface initially smooth but in older lobes becoming obscurely reticulate, often with numerous lobules; lower surface black with brown lobe apices, with repeatedly branched rhizines. Apothecia very rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, P−; with atranorin and chloroatranorin. Medulla K+ yellow turning red, C−, KC−, P+ orange; with salazinic acid.

***Hypotrachyna vexans*** (Zahlbr. ex W.L. Culb. & C.F. Culb.) Divakar, A. Crespo, Sipman, Elix & Lumbsch - Thallus foliose to subfruticose, very loosely adnate, up to 15 cm across, dichotomously or subdichotomously lobed. Lobes ascending, 0.5−2(−4) mm broad, divided, strongly to moderately involute or flat, with abundant, up to 4(−6) mm long, simple or branched cilia. Upper surface grey, slightly to densely isidiate. Isidia up to 1 mm, often bearing lateral black hairs. Lower surface black, paler at the tips, usually erhizinate, rarely with a few short black rhizines. Apothecia very rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Pycnidia rare, 0.1−0.2 mm diam., immersed; conidia bacilliform, straight, c. 5−7 × 1 µm. Photobiont: chlorococcoid. Chemistry: upper cortex K+ yellow, C−, KC−, P+ yellow; medulla K+ yellow then red, C−, P+ yellow then orange; cortex with atranorin and chloroatranorin, medulla with salazinic acid (major), consalazinic acid (minor), galbinic and norstictic acids (accessory).

***Lecanora helva*** Stizenb. - Thallus crustose, continuous to verrucose-areolate. Areoles flat to verruculose, thin, ecorticate, yellowish white to yellowish green, smooth, opaque, epruinose, sorediate. Soredia granulose, in well defined, white to whitish grey soralia 0.1−0.3 mm diam. Apothecia lecanorine, subimmersed when young, sessile when mature, 0.4−1 mm diam.; disc brown, plane, epruinose; margin concolorous with thallus, persistent, entire to verruculose. Amphithecium with large crystals insoluble in K, corticate; epihymenium red-brown, with crystals dissolving in K. Ascospores 8 per ascus, hyaline, simple, ellipsoid, (8−)8.5−11.5(−14) × (4−)4.5−5.5(−7) µm. Pycnidia: immersed, cerebriform; conidia filiform, (14−)15−18 µm long. Photobiont: chlorococcoid. Chemistry: thallus and apothecial margin K+ yellow, C−, KC−, P+ pale orange; with atranorin, 2'-O-methylperlatolic acid (major).

***Lecanora subimmersa*** Müll. Arg. - Thallus crustose, continuous to rimose-areolate; areoles flat, epruinose, ecorticate, yellowish white to grey, smooth, esorediate. Apothecia lecanorine, immersed, aspicilioid, 0.3−0.8 mm in diam.; disc brown to brown-black, plane, epruinose; margin concolorous with thallus, without a parathecial ring; amphithecium absent; parathecium hyaline, containing crystals soluble in K; epihymenium brown, with pigment not dissolving in K, without crystals. Ascospores 8 per ascus, hyaline, simple, ellipsoid, (8−)8.5−14.5(−15) × 4.5−5.5 µm. Pycnidia immersed, cerebriform; conidia filiform, 15−18 µm long. Photobiont: chlorococcoid. Chemistry: thallus K+ yellow, C−, KC−, P+ orange; with atranorin and zeorin (major).

***Leptogium azureum*** (Ach.) Mont. - Thallus foliose, 2−9 cm in diam., adnate, lobate. Lobes irregular, elongate, plane, separate, 1−5 mm wide the apices rotund. Upper surface bluish grey to medium grey, smooth to somewhat roughened but not wrinkled. Upper and lower cortices consisting of a single layer of irregularly isodiametrical cells. Lower surface pale to medium grey,

wrinkled, with scattered tufts of white hairs. Apothecia common, laminal, sessile to short stipitate, 0.2−2.5 mm wide; disc brown; thalline margin entire or occasionally with microphylline outgrowths; exciple euparaplectenchymatous. Ascospores 8 per ascus, hyaline, submuriform (3−5-septate transversely, 0−1-septate longitudinally), ellipsoid to subfusiform, 14−26 × 6−9 µm. Photobiont: cyanobacterial (*Nostoc*). Chemistry: all spot tests negative.

***Leptogium marginellum*** (Sw.) Gray - Thallus foliose, loosely attached; lobes distinct, undulate, more or less spreading; surface dark grey to brownish grey when dry, olive brown when wet, densely folded (plicate), dull; isidia numerous, typically phyllidiate along the apothecial margin, rarely also in granular-coralloid clusters on the thallus surface. Apothecia lecanorine, numerous, laminal, sessile to distinctly stalked; disk brown, margin densely covered with a corona of several rows of granular to elongate-phyllidiate isidia. Ascospores rarely developed, 8 per ascus, hyaline, submuriform. Photobiont: cyanobacterial (*Nostoc*). Chemistry: all spot tests negative.

***Letrouitia domingensis*** (Pers.) Hafellner & Bellem. - Thallus crustose, greenish yellow to orange yellow, smooth to verrucose, lacking soredia and isidia. Apothecia lecideine, round to somewhat distorted, sessile, constricted at base, up to 2 mm in diam. Disc red-brown to black, concave to convex; margin prominent, orange-yellow. Exciple K+ violet-purple, epithecium red-brown, hymenium colourless, hypothecium hyaline. Ascospores (6−)8 per ascus, hyaline, transversely septate, (6−)8(−10)-celled, 21−29(−35) × 6.5−9(−10) µm, with a wavy gelatinous halo. Photobiont: chlorococcoid. Chemistry: thallus and apothecia. K+ red, C−, KC−, P−; with parietin and fragilin.

***Letrouitia transgressa*** (Malme) Hafellner & Bellem. - Thallus crustose, yellow, greenish yellow to yellow-orange, thin, smooth to verrucose; soredia and isidia absent. Apothecia common, lecideine, scattered, rounded or somewhat distorted, constricted at the base, 0.5−1.5 mm wide; disc reddish brown to brown-black, weakly concave to plane; margin prominent, reddish orange, glossy, K+ purple; proper exciple of hyaline radiating agglutinated hyphae, the outer layer encrusted with orange-brown anthraquinone crystals, the inner layer colourless, lacking crystals. Epihymenium encrusted with yellow-brown crystals; hymenium not inspersed, colourless; hypothecium colourless. Ascospores (4−)8 per ascus, hyaline, primarily transversely septate to submuriform, 8−12-celled, 25−60 × 11−20 µm. Photobiont: chlorococcoid. Chemistry: thallus and apothecia K+ red, C−, KC−, P−; with parietin and fragilin.

***Leucodecton occultum*** (Eschw.) Frisch - Thallus crustose, epi- to hypophloedal, pale greyish to pale greenish, smooth to more often roughened, continuous to rarely verrucose, distinctly fissured. Ascomata up to c. 0.6 µm in diam., roundish, apothecioid, solitary, immersed to slightly emergent, then hemispherical. Disc partly visible from surface, greyish, coarsely pruinose. Pores small to moderately wide; proper exciple usually apically visible from surface, roundish to irregular, with an entire to slightly toothed margin. Thalline rim wide to gaping, roundish to slightly elongate, concolorous with thallus, sometimes circularly fissured, forming a ring-like structure. Proper exciple hyaline to pale brownish internally, brownish marginally, sometimes slightly carbonised or dark-brown apically, non-amyloid. Epihymenium moderately hyaline, with grey-brown granules and small crystals. Ascospores 8 per ascus, (sub-)muriform, becoming distinctly brown at early maturity, oblong to ellipsoid, 20−35(−40) × 10−17 µm. Photobiont: trentepohlioid. Chemistry: thallus K+ yellow, then orange-red, C−, P−; with norstictic acid.

***Leucodermia leucomelos*** (L.) Kalb - Thallus foliose to subfruticose, often in loose rosettes or forming tangled mats, loosely adnate or in part unattached, 5−15 cm wide. Lobes 0.5−4.0 mm wide, separate, more or less plane, ribbon-like, dichotomously branched, with conspicuous, grey to black, 5−15 mm long cilia. Upper surface ivory to grey-white, smooth, epruinose. Medulla white. Lower surface mostly ecorticate, canaliculate, arachnoid or powdery, sometimes with subapical soralia, white throughout. Apothecia very rare, lecanorine. Ascospores 8 per ascus, brown, 2-celled. Pycnidia rare, immersed; conidia bacilliform, 4−5 × 1 µm. Photobiont: chlorococcoid.

Chemistry: cortex K+ yellow, C−, KC−, P+ yellow; medulla K+ yellow then red, C−, P+ yellow-orange; with atranorin and zeorin.

***Marcelaria benguelensis*** (Müll. Arg.) Aptroot, Nelsen & Parnmen - Thallus crustose, olive-green but partly to completely orange-pruinose. Perithecia immersed in fruiting warts which are 0.6−1 mm diam., up to 0.7 mm high, arranged in clusters of 2−6 warts which reach 2.5 mm diam., bright (orange) yellow, smooth to rough, often slightly shiny. Excipulum brown-black, carbonised; hamathecium densely inspersed. Ascospores 8 per ascus, hyaline, I−, muriform with 15−23 transverse septa and 3−7 longitudinal septa per segment, 50−80 × 17−23 µm, surrounded by a thick gelatinous sheath. Photobiont: trentepohlioid. Chemistry: thallus, K− or K+ blood-red where orange pigment is present; warts UV+ yellow, K+ blood-red with a purplish hue; with parietin and teloschistin, plus a lichexanthone.

***Nigrovothelium tropicum*** (Ach.) Lücking, M.P. Nelsen & Aptroot - Thallus crustose, corticate, olive-green to yellowish brown, smooth to uneven. Ascomata trypethelioid, with apical ostioles, solitary, but usually densely crowded, 0.2−0.3 mm diam., prominent to sessile, subglobose to barrel-shaped with a flattened top, black with a greyish ostiolar area. Hamathecium non inspersed. Ascospores 8 per ascus, hyaline, 4-celled, fusiform-ellipsoid, 20−25 × 7−10 µm, I−. Photobiont: trentepohlioid. Chemistry: thallus and ascomata K−, C−, KC−, P−, UV−, no lichen substances. Syn.: *Trypethelium tropicum* (Ach.) Müll. Arg.

***Ocellularia perforata*** (Leight.) Müll. Arg. - Thallus crustose, endo- to epiphloeodal, pale greenish grey to pale olive, smooth, continuous to verrucose. Ascomata conspicuous at maturity, to c. 0.6 mm diam., rounded to irregular, becoming apothecioid, solitary to fused, immersed to somewhat emergent. Disc with the columella visible at maturity, epruinose to distinctly pruinose, white to brownish or dark grey, free, entire. Pores formed by the thalline rim to c. 0.4 mm diam., entire to split. Proper exciple yellowish brown internally, dark brown marginally. Hymenium not inspersed; columellar structures well developed at maturity, brownish to carbonised. Ascospores (4−)8 per ascus, hyaline, transversely septate, rarely with a single longitudinal septum, oblong to fusiform, amyloid, 15−35(−40) × 7−10(−12) µm, with 4−10(−12) locules, the wall non-halonate. Chemistry: thallus K+ yellowish brown, C−, P+ orange-red; with protocetraric acid.

***Pallidogramme chrysenteron*** (Mont.) Staiger, Kalb & Lücking - Thallus crustose, thin, pale fawn, smooth. Lirellae white, conspicuous, numerous, scattered, sessile, slightly sulcate, curved to sinuous, often branched, 1−5(−8) × 0.4−0.6 mm; lips closed. Exciple reddish brown, entire, occasionally poorly developed. Hymenium inspersed. Ascospores 8 per ascus, hyaline to pale brown, muriform, 50−75 × 9−12(−18) µm. Photobiont: trentepohlioid. Chemistry: thallus K+ bright yellow, with stictic acid (major), and constictic acid (minor).

***Parmelinella wallichiana*** (Taylor) Elix & Hale - Thallus foliose, 5–10 cm wide, closely adnate on bark; lobes 5–10 mm wide, rounded, shortly ciliate in lobe axils; upper surface grey to grey–green, smooth, emaculate, sparsely isidiate; isidia granular to branched-cylindrical, straight to twisted, erect, firm to partially caducous, concolorous with upper cortex or with brownish apices, eciliate; lower surface black, with a naked or papillate, brown marginal zone; rhizines simple. Apothecia rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Cortex K+ yellow, C−, P−, with atranorin. Medulla K+ yellow turning red, C−, KC–, P+ orange-red, with salazinic and consalazinic acids.

***Parmotrema cristiferum*** (Taylor) Hale - Thallus foliose, adnate to loosely adnate, 3−15 cm diam. Lobes slightly imbricate, plane, separate, 4−20 mm wide; apices rotund, sometimes deeply crenate; cilia sparse to frequent, 0.3−2.0 mm long. Upper surface grey, smooth, dull, emaculate. Soredia granular, in linear, submarginal soralia that are often on lateral, subascending lobes. Medulla white. Lower surface black, with a brown, erhizinate marginal zone, centrally rhizinate; rhizines

scattered, simple. Apothecia very rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: upper cortex K+ yellow, C−, KC−, P−, with atranorin and chloroatranorin; medulla K+ yellow turning deep red, C−, KC−, P+ orange; with salazinic acid (major) and consalazinic acid (minor).

***Parmotrema gardneri*** (C.W. Dodge) Sérus. - Thallus foliose, adnate to loosely adnate, 3−10 cm diam. Lobes plane, separate, 8−15 mm wide, the apices rotund, subascending, eciliate or short cilia developing in the axils. Upper surface grey with some blackened areas, smooth, usually shiny, emaculate, reticulately cracked with age. Soredia granular, common, in linear to subcapitate, marginal soralia. Medulla white. Lower surface black with a peripheral brown, erhizinate zone, centrally rhizinate; rhizines scattered, simple. Apothecia: rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: upper cortex K+ yellow, C−, KC−, P−, with atranorin and chloroatranorin; medulla K−, C−, KC−, P+ red, with protocetraric acid.

***Parmotrema maclayanum*** (Müll. Arg.) Hale - Thallus foliose, loosely adnate, 6−10 cm wide. Lobes irregular, rounded, 8−20 mm wide, with sparsely ciliate margins. Upper surface pale grey, lacking soredia and isidia; lower surface black with a dark brown, erhizinate marginal zone; rhizines simple, scattered. Apothecia lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, P−, with atranorin. Medulla K−, C−, KC+ purple, P+ red, UV+ blue-white, with alectoronic and α-collatolic acids, and more or less gyrophoric acid.

***Parmotrema overeemii*** (Zahlbr.) Elix - Thallus foliose, moderately to loosely adnate, membranaceous, up to 10 cm wide. Lobes subirregular to sublinear, with black, 0.5−1.5 mm long cilia. Upper surface pale yellow grey to grey green, parly blackened, emaculate, smooth to more or less reticulately cracked, lacking isidia and soredia. Lower surface black with a brown, erhizinate marginal zone; rhizines moderately dense, simple. Apothecia lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, P−, with atranorin. Medulla K+ dirty brown, C−, KC+ pink-red, P+ deep orange, with protocetraric acid.

***Parmotrema praesorediosum*** (Nyl.) Hale - Thallus foliose, adnate, up to 8 cm wide. Lobes rounded, 4−7 mm wide, with eciliate, suberect, sorediate margins. Upper surface pale grey, emaculate, fragile and cracked in older parts; soredia granular. Lower surface black with a mottled, narrow (1−2 mm wide) erhizinate, brown margin; rhizines sparse, simple, 1−2 mm long. Apothecia very rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, P−, with atranorin. Medulla K−, C− KC− P−, with protopraesorediosic and praesorediosic acids.

***Parmotrema saccatilobum*** (Taylor) Hale - Thallus foliose, to 8 cm wide, closely adnate. Lobes subirregular or becoming convoluted, 4−7 mm wide, eciliate. Upper surface dull, emaculate, grey to yellowish grey, with mainly simple, fragile, moderately dense isidia. Lower surface black with a shining, brown, erhizinate margin; rhizines sparse, simple. Apothecia very rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, P−, with atranorin; medulla K− or K+ dirty brown, C−, KC+ red/brown, P+ brick red, with protocetraric acid.

***Parmotrema tinctorum*** (Despr. ex Nyl.) Hale - Thallus foliose, loosely adnate, 5−15(−30) cm wide. Lobes broadly rounded, flattened, 10−20 mm wide, with eciliate margins. Upper surface green-grey to grey with mainly laminal, simple to branched or lobulate isidia. Lower surface black with a brown erhizinate margin; rhizines sparse, simple. Apothecia very rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, P−, with atranorin; medulla K−, C+ red, KC+ red, P−, with lecanoric acid.

***Pertusaria cicatricosa*** Müll. Arg. - Thallus crustose, pale yellowish white to pale yellowish green, slightly tuberculate and cracked, smooth and dull. Apothecia numerous, conspicuous, perithecioid-verruciform, concolorous with the thallus, crowded, sometimes confluent, flattened-hemispherical, often irregular in outline, occasionally becoming constricted at the base, 0.8−1.5 mm diam. Ostioles inconspicuous, pale brown or translucent, 0.1−0.2 mm diam., 1(−3) per verruca, sometimes slightly sunken. Ascospores 2 per ascus, hyaline, ellipsoidal, the surface sculptured, 100−150(−200) × 35−50 µm. Photobiont: chlorococcoid. Chemistry: thallus K−, KC−, C−, P−; with 2,4,5-trichlorolichexanthone, and stictic acid (major).

***Pertusaria leioplaca*** DC. - Thallus crustose, continuous to superficially fissured, covered with flat verrucae, ash grey to green-grey, often shiny; thallus margin unzoned. Fertile verrucae concolorous with thallus, numerous, c. 0.7−2.5 mm in diam.; ostioles 1−6 per verruca, hyaline. Ascocarps perithecioid apothecia, (1−)2−4(−6) per verruca; epithecium hyaline to brown; hypothecium hyaline to yellowish. Ascospores 4 per ascus, hyaline, ellipsoid, 40−130 × 25−50 µm; spore wall 2-layered, the outer wall c. 1−7 µm thick; inner spore wall 2−12 µm thick. Pycnidia immersed; conidia bacilliform, 7−10 × 0.5−1.0 µm Photobiont: chlorococcoid. Thallus K−, C−, KC−, P+ yellow to orange, UV−, with 4,5-dichlorolichexanthone and stictic acid.

***Phaeographis brasiliensis*** (A. Massal.) Kalb & Matthes-Leicht - Thallus crustose, pale fawn, thin, smooth, slightly glossy. Lirellae inconspicuous, black, open, simple or branched, straight, curved or in substellate clusters, immersed to subsessile, 0.5−1.5 × 0.15−0.30 mm, with a thalline margin, lacking a proper exciple. Disc black, often white-pruinose. Hymenium not inspersed. Ascospores 8 per ascus, pale brown, 4-celled, 15−22(−25) × 6−9 µm. Photobiont: trentepohlioid. Chemistry: thallus K+ first yellow, then orange-red, C−, P−, with norstictic acid.

***Phaeographis caesioradians*** (Leight.) A.W. Archer - Thallus crustose, pale olive-green, thin, smooth, glossy. Lirellae conspicuous, numerous, scattered, straight, curved or sinuous, often branched, sessile, with a thalline margin, 1−4 mm × 0.3−0.4 mm, the lips open, exposing a white-pruinose disc. Exciple non-carbonised, rarely weakly carbonised and apically darkened. Hymenium not inspersed. Ascospores 8 per ascus, pale brown, submuriform to muriform, 23−35 × 10−13 µm. Photobiont: trentepohlioid. Chemistry: all spot tests negative.

***Phaeographis intricans*** (Nyl.) Staiger - Thallus crustose, pale fawn, thin, smooth, glossy. Lirellae thin, intricately branched, 0.05−0.15 mm wide, immersed in raised, pale fawn, circular to oval, 1−3 mm wide stromata. Disc black, finely white-pruinose; exciple non-carbonised, pale yellow-brown, complete, thick below. Hymenium not inspersed. Ascospores 8 per ascus, pale brown, transversely septate, (4−)6-celled, 16−20 × 5−7 µm. Photobiont: trentepohlioid. Chemistry: thallus K+ first yellow, then orange-red, C−, P−, with norstictic acid.

***Phyllopsora soralifera*** Timdal - Thallus squamulose, effuse. Squamules up to 0.5 mm wide, adnate or weakly ascending, crenulated to incised, plane to weakly convex; upper side green, dull, epruinose. Soralia common, developing from the margin of the squamules, soon capitate on the upper side; soredia farinose. Apothecia very rare, lecideine, up to 0.8 mm diam., weakly to moderately convex, pale brown, with an indistinct, concolorous margin. Ascospores bacilliform to acicular, with (1−)3(−4) indistinct pseudosepta, 17−27.5 × 2−2.5 µm. Photobiont: chlorococcoid. Chemistry: thallus K−, C−, P−, without lichen compounds.

***Physcia poncinsii*** Hue - Thallus foliose, orbicular to irregular, up to 5 cm diam., closely adnate. Lobes up to 2 mm wide (usually less), imbricate to distinctly separated. Upper surface white to dark grey, sometimes with white dots, sorediate. Soredia mainly in laminal, crateriform to subcapitate, usually orbicular soralia. Upper cortex paraplectenchymatous; medulla white; lower surface white to pale brownish grey, with white to dark grey, simple rhizines. Apothecia rare, lecanorine. Ascospores 8 per ascus, brown, 2-celled. Photobiont: chlorococcoid. Chemistry: cortex

and medulla K+ yellow, C−, KC−, P+ yellow; cortex with atranorin, medulla with atranorin and zeorin.

***Physcia undulata*** Moberg - Thallus foliose, irregular to orbicular, up to 4 cm diam. Lobes thin, loosely adnate to ascending, up to 2 mm wide, the tips rounded, eciliate. Upper surface grey to dark grey, pruinose, sorediate. Soredia in marginal soralia that give the margins an undulate appearance. Upper cortex paraplectenchymatous; medulla white; lower surface whitish grey to brownish, with concolorous or darker, simple rhizines Apothecia rare, lecanorine. Ascospores 8 per ascus, brown, 2-celled. Photobiont: chlorococcoid. Chemistry: cortex and medulla K+ yellow, C−, KC−, P+ yellow; upper cortex with atranorin; with atranorin, zeorin and additional triterpenes.

***Physma byrsaeum*** (Ach.) Tuck. - Thallus foliose, more or less rosulate, adnate, 3−10 cm wide. Lobes radiating, oblong to linear-oblong, 1.5−10 mm wide; margins entire, thickened, more or less recurved. Upper surface ridged, wrinkled or smooth in parts, leaden grey to olive green, becoming brown to black with age, sometimes spotted. Lower surface brown, rhizinate; rhizines of interwoven hyphae forming an indumentum, black. Apothecia usually abundant, laminal, sessile, 1.5−4 mm diam.; disc concave to plane or slightly convex, pale orange to reddish brown; thalline exciple thick, sometimes plicate, concolorous with thallus. Ascospores 8 per ascus, hyaline, simple, ellipsoidal, 13−20 × 10−13 µm. Pycnidia laminal; conidia 3−4 µm long. Photobiont: cyanobacterial. Chemistry: all spot tests negative.

***Platygramme pudica*** (Mont. & Bosch) M. Nakan. & Kashiw. - Thallus crustose, pale olive-green, thin, smooth, and glossy. Lirellae numerous, scattered, sessile, greyish black, with a conspicuous thalline margin, curved or sinuous, occasionally branched, 1−7 mm long, 0.7−0.9(−1.0) mm wide. Proper exciple laterally carbonised, hidden by the thalline margin, red-brown at the base. Ascospores 1 per ascus, pale brown, muriform, 160−200 × 30−40 µm. Photobiont: trentepohlioid. Chemistry: thallus K−, C−, KC−, P+ orange-red, with echinocarpic acid.

***Polyblastidium microphyllum*** (Kurok.) Kalb - Thallus foliose, orbicular to irregularly spreading, loosely adnate, 5−15 cm wide. Lobes 0.5− 2.0 mm wide, plane to weakly convex or concave, sublinear-elongate, branched; apices not ascending, with short lateral lobes, eciliate. Upper surface grey-white to grey, epruinose, with marginal lobules, or entire phyllidia becoming granular and appearing sorediate. Medulla white; lower surface ecorticate, white to greyish or pale brown in the centre. Rhizines numerous, mainly marginal, concolorous with thallus or darkening, irregularly branched. Apothecia rare, laminal, lecanorine, the margin phyllidiate-sorediate. Ascospores 8 per ascus, brown, 2-celled. Pycnidia initially immersed, becoming emergent, black; conidia bacilliform, 3−5 × 1 µm. Photobiont: chlorococcoid. Chemistry: cortex and medulla K+ yellow, C−, KC−, P+ yellow; with atranorin and zeorin.

***Polymeridium catapastum*** (Nyl.) R.C. Harris - Thallus crustose, ecorticate, white to grey, smooth to uneven. Ascomata perithecioid, without pseudostromatic tissues, globose to pyriform, erumpent from the substratum, with apical ostioles, solitary, 0.3−0.4 mm, exposed and black, but ostiolar area sometimes whitish. Hamathecium not inspersed. Ascospores 8 per ascus, hyaline, 4-celled, fusiform, 25−33 × 7−10 µm, I−, the wall smooth. Photobiont: trentepohlioid. Chemistry: thallus, K−, C−, P−, UV+ yellow, with lichexanthone.

***Porina mastoidea*** (Ach.) Müll. Arg. - Thallus crustose, episubstratal, continuous to areolate, pale grey to pale grey-green, smooth to irregularly rugulose, corticate, usually with a brown-black basal layer; prothallus whitish, brown-black or not apparent. Perithecial verrucae convex to hemispherical, 0.35−0.9 mm diam.; wall with a layer of colourless crystals; apex plane to convex; ostiole inconspicuous or in a shallow depression; periostiolar area usually black. Involucrellum apical to dimidiate, pale to medium brown below the apex. Exciple pale yellow-brown to orange-brown. Ascospores 8 per ascus, brown, fusiform to elongate-cylindrical, tranversely septate, 8-

celled, 32−66 × 6−13 µm. Pycnidia conspicuous, resembling miniature perithecial verrucae; conidia fusiform to elongate-fusiform, 3−5 × 1 µm. Photobiont: trentepohlioid. Chemistry: thallus K+ dull orange-brown or red-brown, C−, KC−, P−.

***Pyrenula anomala*** (Ach.) Vain. - Thallus crustose, corticate, brownish to blackish, without pseudocyphellae. Perithecia densely aggregated in irregular groups with separate ostioles, subglobose, superficial, not covered by thallus, c. 0.3−0.6 mm diam. Perithecial wall without crystals. Ostiole pale, mostly apical. Hamathecium not inspersed, I−; filaments unbranched. Ascospores 8 per ascus, grey-brown, irregularly biseriate, transversely septate, 4-celled, fusiform with pointed to rounded ends, 15−21 × 6−8 µm; lumina angular, terminal lumina separated from the exospore by an endospore layer. Photobiont: trentepohlioid. Chemistry: all spot tests negative.

***Pyrenula aspistea*** (Ach.) Ach. - Thallus crustose, brownish to olive-green, without pseudocyphellae, corticate. Perithecia solitary, flattened to conical, erumpent from the substratum, the sides often partly covered by the thallus, c. 0.3−0.5 mm diam. Perithecial wall without crystals; ostiole apical, pale. Hamathecium not inspersed, I−. Ascospores 8 per ascus, irregularly biseriate, grey to brown, transversely septate, 4-celled, with rounded ends, 12−15 × 4−6 µm; lumina angular; terminal lumina separated from the exospore by an endospore layer. Photobiont: trentepohlioid. Chemistry: all spot tests negative.

***Pyrenula breutelii*** (Müll. Arg.) Aptroot - Thallus crustose, corticate, brownish to olive green, with pseudocyphellae. Perithecia solitary, subglobose, erumpent from the substratum, the sides often partly or mostly covered by thallus, c. 0.3−0.5 mm diam. Perithecial wall with crystals, up to 100 µm thick. Ostiole pale, apical. Hamathecium not inspersed, I+ orange, filaments unbranched. Ascospores 8 per ascus, grey-brown, irregularly biseriate, muriform with c. 8 rows of c. 3−8 cells, fusiform with rounded ends, 38−50 × 15−20 µm; lumina rounded, old spores with orange oil. Photobiont: trentepohlioid. Chemistry: all spot tests negative.

***Pyrenula immissa*** (Stirt.) Zahlbr. - Thallus crustose, endophloedal, yellowish brown-buff, pseudocyphellate, smooth-verrucose (verrucae associated with ascocarp formation). Perithecia solitary or 1−4 coalescing, 0.6−1.5 mm diam., convex-hemispherical, completely embedded in verrucae or emerging partly, or completely covered with a corticiform layer, dull black; ostioles indistinct or surrounded by a flat, whitish circular area; perithecial wall black and carbonaceous, 50−70 µm thick at top, 20−30 µm thick at the base; centrum of perithecia I−, with abundant oil droplets; paraphysoids simple; asci clavate-cylindrical. Ascospores 8 per ascus, uniseriate, brown, transversely septate, 4-celled, oblong-ellipsoid, 32−45 × 15−27 µm. Photobiont: trentepohlioid. Chemistry: all spot tests negative.

***Pyxine berteriana*** (Fée) Imshaug - Thallus foliose, 5−10 cm wide, adnate, subdichotomously lobate. Lobes radiating, discrete to contiguous, plane to convex, but often slightly concave towards the tips, 0.5−1.5 mm wide, subrotund at the apices. Upper surface white to greenish grey or yellow-grey, sparsely pruinose at lobe tips or epruinose. Pseudocyphellae distinct, marginal and laminal, subreticulate. Medulla pale yellow in upper part, white in lower part. Lower surface black in the centre, paler towards the margin; rhizines dense, furcate. Apothecia common, 0.5−2.0 mm wide; disc epruinose, internal stipe distinct, white. Ascospores 8 per ascus, brown, 2-celled, 15−22 × 6−8 µm. Photobiont: chlorococcoid. Chemistry: cortex K−, C−, P−, UV+ yellow; medulla K− or K+ pale red, C−, KC−, P− or P+ orange; with lichexanthone, triterpenes, and an unknown pigment (trace).

***Pyxine coccifera*** (Fée) Nyl. - Thallus foliose, 2−6 cm wide, adnate to loosely adnate, subdichotomously lobed. Lobes radiating, discrete to weakly contiguous, plane to convex, but often slightly concave towards tips, 0.4−1.2 mm wide, subrotund at apices. Upper surface grey to dull yellow, sparsely pruinose at lobe tips or epruinose. Pseudocyphellae bright red, marginal and

laminal, subreticulate, often developing into soralia. Soralia marginal and laminal, orbicular to linear, becoming excavate, producing bright red and grey granular soredia. Medulla pale yellow in upper part, white in lower part. Lower surface black in the centre, paler towards the margin; rhizines dense, furcate. Apothecia very rare; internal stipe distinct, pale yellow in the upper part, white below. Ascospores 8 per ascus, brown, 2-celled, 14−18 × 6−8 μm. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, P−, UV−; medulla K−, C−, KC−, P−; red-pigmented medulla K+ purple, C+ purple-brown, KC+ violet, P−; with atranorin, chloroatranorin, chiodectonic acid, methyl pyxinate.

***Pyxine cocoës*** (Sw.) Nyl. - Thallus foliose, 3−10 cm wide, adnate, dichotomously lobed. Lobes radiating, discrete to contiguous, plane to slightly convex or concave, 0.4−0.8 mm wide, subrotund to truncate at apices. Upper surface white to pale yellow-brown, patchily pruinose; pruina glistening. Pseudocyphellae usually retricted to the margins, rarely laminal or becoming reticulately confluent, often developing into soralia. Soralia marginal and laminal, orbicular to linear, often coalescing into extensive patches; soredia granular. Medulla uniformly white. Lower surface black in the centre, paler towards the periphery; rhizines dense, furcate. Apothecia rare; internal stipe distinct, reddish brown in the upper part and K+ purple, P−. Ascospores 8 per ascus, brown, 2-celled, 15−18 × 6−7 μm. Conidia bacilliform, 3−4 × c. 1 μm. Photobiont: chlorococcoid. Chemistry: cortex K−, C−, P−, UV+ yellow; medulla K−, C−, KC−, P−; with lichexanthone and traces of unknown terpenes.

***Pyxine cylindrica*** Kashiw. - Thallus foliose, 2−5 cm wide, adnate, subdichotomously lobed. Lobes radiating, discrete to imbricate, plane to slightly convex, 0.3−0.6 mm wide, subrotund to truncate at apices. Upper surface white to yellowish grey, sparsely pruinose at the lobe tips or epruinose. Pseudocyphellae distinct, marginal and laminal, irregular. Isidia laminal, cylindrical, simple or sparingly branched, 0.3−0.8 mm tall, c. 0.1 mm wide. Medulla white. Lower surface black in the centre, paler towards the margin; rhizines dense, furcate. Apothecia extremely rare. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, KC−, P+ yellow, UV−; medulla K+ yellow red, C−, P+ orange; with norstictic acid (major), atranorin (minor), and unknown terpenes (minor).

***Pyxine retirugella*** Nyl. - Thallus foliose, 2−5 cm wide, adnate, subdichotomously lobed. Lobes irregular, discrete to imbricate, plane to weakly convex but often slightly concave towards the tips, 0.3−1.0 mm wide, subrotund at the apices. Upper surface whitish to yellow-grey, pruinose towards the lobe tips or epruinose. Pseudocyphellae marginal and laminal, irregular, linear or becoming reticulate. Dactyls laminal and marginal, scattered or clustered, nodular to subcylindrical, short, more or less branched, pustulate, bursting apically to produce granular soredia. Medulla white. Lower surface black in the centre, paler towards the margin; rhizines dense, furcate. Apothecia rare; internal stipe distinct, white to pale brown, K−, P−. Ascospores 8 per ascus, brown, 2-celled, 17−22 × 6−9 μm. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, KC−, P+ yellow, UV−; medulla K+ yellow turning red, C−, P+ orange; with atranorin (minor), chloroatranorin (minor), norstictic acid (major), testacein (minor), and unknown terpenes (minor).

***Ramboldia russula*** (Ach.) Kalb, Lumbsch & Elix - Thallus crustose, whitish grey, dull, continuous to weakly rimose. Apothecia lecideine, bright red, 0.4−0.8 mm in diam., first plane then soon convex. Epiphymenium with golden yellow, K+ red crystals; hymenium and hypothecium hyaline. Ascospores 8 per ascus, hyaline, simple, 10−14 × 2−3.5 μm. Photobiont: chlorococcoid. Chemistry: thallus K+ yellowish to yellowish brown, but not turning red, C−, P+ red, UV+ yellow-reddish; apothecia K+ red; with lichexanthone, fumarprotocetraric acid, russulone.

***Relicinopsis intertexta*** (Mont. & Bosch) Elix & Verdon - Thallus foliose, adnate, coriaceous, 3−10 cm wide. Lobes contiguous centrally to separate at the periphery, sublinear-elongate, dichotomously to subdichotomously branched, 0.5−2 mm wide, eciliate. Upper surface greenish grey, dull, faintly maculate, smooth to cracked. Lower surface pale brown to tan; primary rhizines

moderately dense, scattered, with a thick mass of fine, pale tan, densely branched or agglutinated secondary rhizines developing from primary rhizines. Apothecia common, lecanorine, to 2 mm wide; disc flat to shallowly concave, brown. Ascospores 8 per ascus, simple, 5−7 × 3−5 µm. Pycnidia common; conidia fusiform to bacilliform, 5−7 × 1 µm. Photobiont: chlorococcoid. Chemistry: upper cortex K+ yellowish, C−, P−, UV−; medulla K− or K+ pale brown, C and KC+ pink, P+ orange; with usnic acid, atranorin, protocetraric acid and variable amounts of protolichesterinic acid.

***Relicinopsis malaccensis*** (Nyl.) Elix & Verdon - Thallus foliose, adnate, 4−5 cm wide. Lobes sublinear and imbricate, 0.8−1.5 mm wide, with eciliate margins; upper surface yellow green, transversely cracked with dense, mostly simple, small (to 0.3 mm high) isidia; lower surface pale to dark brown, with dense, simple rhizines to margins. Apothecia very rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: upper cortex K−, C−, P−, with usnic acid (major) and atranorin; medulla K−, C−, KC−, P+ orange, with protocetraric acid.

***Relicinopsis rahengensis*** (Vain.) Elix & Verdon - Thallus foliose, adnate, 3−6 cm wide. Lobes 0.5−1.5 mm wide, with eciliate margins; upper surface yellow green with dense, simple or branched isidia, mainly in the older parts; lower surface pale to dark brown, with dense, mainly simple to sparsely branched rhizines. Apothecia very rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K−, C−, P−, with usnic acid; medulla K−, C−, KC+ yellow, P− or P+ pale orange; with barbatic acid.

***Remototrachyna kingii*** (Hale) Divakar & A. Crespo - Thallus foliose, up to 10 cm wide, loosely adnate. Lobes sublinear, subimbricate, 2−5 mm wide, rounded at apices; upper surface mineral grey, flaking, pustulate but not sorediate; lower surface black, moderately rhizinate with a narrow erhizinate margin. Apothecia rare, lecanorine. Ascospores 8 per ascus, hyaline, simple. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow, C−, KC−, P−, with atranorin. Medulla K+ yellow turning red, C−, KC−, P+ orange, with salazinic and norstictic acids.

***Rinodina oxydata*** (A. Massal.) A. Massal. - Thallus crustose, thin, rimose to areolate; areoles up to 0.3−0.6 mm wide, plane. Surface light to dark grey or ochraceous, dull. Apothecia lecanorine, adnate, frequent, 0.35−0.6 mm in diam; disc black to reddish brown when wet, plane; thalline margin concolorous with thallus, frequently blackening with age. Epihymenium light brown; hypothecium hyaline. Ascospores 8 per ascus, brown, 2-celled, broadly ellipsoid, (15−)18.5−20(−23) × (7.5−)10−11.5(−14) µm. Pycnidia immersed; conidia bacilliform, 4−5 × 1−1.5 µm. Photobiont: chlorococcoid. Chemistry: thallus K+ yellow, C−, KC−, P+ faintly yellow, with atranorin in cortex.

***Sarcographa glyphiza*** (Nyl.) Kr.R. Singh & G.P. Sinha - Thallus crustose, yellowish to brownish, smooth. Stromata black, irregular in outline. Lirellae compact, immersed to prominent, triradiate to irregularly flexuous, branched, 2−4 mm long, 0.2−0.3 mm wide; margin thin, black; disc closed to open; exciple brown-black, complete; labia convergent, covered outside by thalline tissue and crystal patches. Ascospores 8 per ascus, pale brown, transversally 5−7- and longitudinally 1-septate. Chemistry: thallus K+ red, C−, KC−, P+ yellow, with constictic, norstictic and stictic acid.

***Sarcographa labyrinthica*** (Ach.) Müll. Arg. - Thallus crustose, pale olive-green, thin, smooth and shiny. Lirellae much branched, open, 0.1−0.2 mm wide, immersed in conspicuous, raised, white, 1−4 mm wide stromata; disc dull black, epruinose or weakly white-pruinose; proper exciple completely carbonised, thick at the base. Ascospores 8 per ascus, 4-celled, pale brown, 17−21(−23) × 6−7 µm. Photobiont: trentepohlioid. Chemistry: thallus K+ yellow, C−, P−, with stictic acid.

***Stegobolus fissus*** (Müll. Arg.) Frisch - Thallus crustose, endo- to epiphloeodal, pale greenish to pale olive, continuous to verruculose. Ascomata apothecioid, to c. 2 mm diam., rounded to

irregular, moderately to distinctly emergent, urceolate to subglobose. Disc with the columella visible from above, distinctly pruinose, white to brownish. Pores formed by the thalline margin to c. 1.8 mm diam., rounded to irregular, the proper exciple becoming visible from above as a dark brown ring. Proper exciple brownish to carbonised. Hymenium not inspersed; columellar structures variable, well developed, to c. 1.5 mm wide, replacing large parts of the hymenium, carbonised. Epihymenium hyaline to brownish. Ascospores 8 per ascus, pale to brown at maturity, transversely septate to submuriform, oblong to ellipsoidal, distinctly amyloid, 8−20(−22) × 6−10(−12) µm, non-halonate. Photobiont: trentepohlioid. Chemistry: thallus K+ yellowish, C−, P+ yellow, with psoromic acid.

***Sulcopyrenula subglobosa*** (Riddle) Aptroot - Thallus crustose, whitish, nearly immersed in the bark, without pseudocyphellae and hypothallus. Perithecia mostly immersed in the thallus, globose, black, 0.3−0.6 mm diam. Ostiole central, conical, black. Asci cylindrical, I−, without ocular chamber. Paraphyses simple or branched at the tips. Ascospores chocolate-brown, 8 per ascus, uniseriate, distoseptate, with 4 locules in two rows, subglobose, without a gelatinous sheath. Photobiont: trentepohlioid. Chemistry: thallus K−, C−, KC−, P−, UV+ yellow (lichexanthone).

***Trypethelium eluteriae*** Spreng. - Thallus crustose, corticate, olive-green to yellowish, smooth to uneven. Ascomata trypethelioid, completely immersed in pseudostromata, with apical ostioles. Pseudostromata containing numerous ascomata, 1−2 mm diam., prominent to almost sessile, cream-coloured to dark brown, but usually covered by a yellow to orange, K+ purple and UV+ red pigment. Hamathecium not inspersed. Ascospores 8 per ascus, hyaline, transversely 9−13-septate, 37−52 × 8−11 µm. Photobiont: trentepohlioid. Chemistry: thallus K−, C−, P−, UV−; pseudostromata containing a yellow to orange, K+ purple, UV+ red anthraquinone.

***Usnea baileyi*** **(Stirt.)** Zahlbr. - Thallus fruticose, erect to subpendant, shrubby, with a hollow axis, 6-11 cm long, green to blackening in age. Base of thallus blackened, without annular crackings. Branching subisotomic dichotomous, the lateral branches not restricted at point of attachment, narrow, terete, uninflated. Cortex dull, thin; medulla thin, with a deep red pigment at border of medulla and cortex; central axis very thick, non-pigmented, fistulose. Soralia absent, but soredia sometimes produced from eroded tubercles; isidiomorphs rare. Fibrils numerous, short, with a fishbone pattern. Tubercles numerous, raised. Apothecia rare, terminal on short side branches lecanorine. Photobiont: chlorococcoid. Chemistry: thallus K+ yellow turning red, C−, KC−, P+ orange, with usnic acid, norstictic acid (major), plus variable amounts of salazinic and barbatic acids.

***Usnea pectinata*** Taylor - Thallus fruticose, pendant, 25−50 cm in length, pale greyish green to greenish yellow, the base concolorous to black. Branching anisotomic dichotomous, the branches with annular cracks and/or decorticate. Isidiomorphs absent or present, soralia absent; fibrils numerous, with a fishbone pattern. Tubercles absent; papillae occasional, spaced on main branches. Cortex glossy when intact, thin, sometimes decorticate, medulla very dense and compact, the central axis very thick, pigmented lightly ochraceous to brownish. Apothecia very rare, lecanorine. Photobiont: chlorococcoid. Chemistry: with usnic acid (major), and variable amounts of protocetraric, barbatic, salazinic and constictic acids.

***Usnea rubicunda*** Stirt. - Thallus fruticose, erect-shrubby to subpendant, 3−15 cm long; branching anisotomic-dichotomous, the branches with punctiform soralia, irregular in outline, even or slightly stipitate, plane to erumpent; isidiomorphs always present, generally numerous and conspicuous on secondary and terminal branches. Cortex shiny to vitreous, hard, frequently transversally or longitudinally cracked, with a red pigment; medulla not pigmented. Apotecia very rare, lecanorine. Photobiont: chlorococcoid. Chemistry: cortex K+ yellow slowly turning orange, C−, KC−, P+ deep orange, with usnic and stictic acids (major).

# Lichens - an overview and glossary
## (including a Thai glossary)

Before starting the identification of lichens, we recommend to study at least one of the many good introductory texts of Lichenology. This brief summary shows the main characters that are used for the identification of lichens. The Italian version was prepared as an aid in the first Lichenology Labs for students of Systematic Botany at the University of Trieste, and is associated to all interactive identifications keys of project *Dryades* devoted to lichens. A comprehensive glossary is also included. All images are released with a CC BY-SA 4.0 license, which means that anybody can use them, provided that both the Author (A. Moro) and the license are cited. At the end, we also add a Thai glossary, prepared and illustrated at the Department of Biology, Faculty of Science, Ramkhamhaeng University, Bangkok.

## Growth-forms and general appearance

One of the first things you have to learn to identify lichens is to recognize their major growth-forms.

**Fruticose lichens**: they develop in 3 dimensions, with extremely variable forms (thread-like, cup-shaped, bushy, etc.). In the following, we give some examples.

Thread-like fruticose lichens (*Usnea).*

Thread-like fruticose lichens (*Bryoria).*

Fruticose thalli of *Ramalina*.

Fruticose thalli of *Teloschistes*.

Pseudopodetia of *Stereocaulon.*

Bushy fruticose thalli of *Bunodophoron.*

**Foliose lichens**: they develop in 2 dimensions (like a leaf) and the lower surface is attached to the substrate through organs similar to rootlets (rhizines). The lobes are lifted from the substrate at least at the apex. In the following, we give some examples.

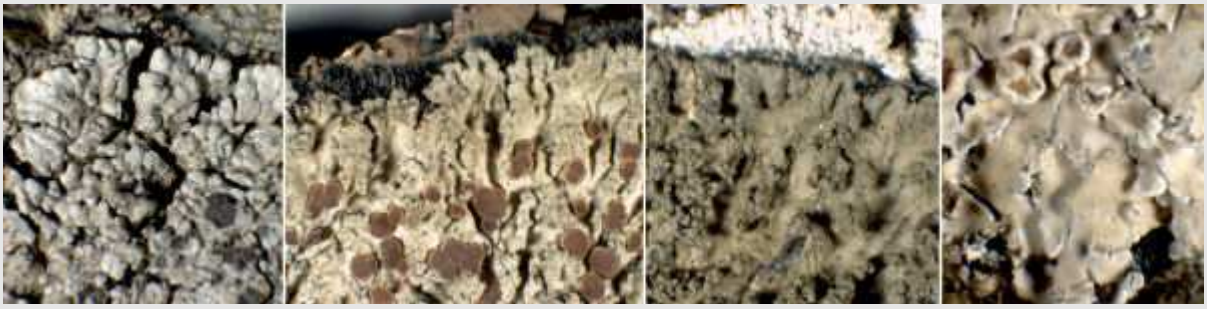
Broad-lobed foliose thalli of Parmeliaceae.

Broad-lobed foliose thalli of *Parmelina*.

Broad-lobe foliose thalli of *Parmotrema*.

Narrow lobed foliose thalli of *Physcia*.

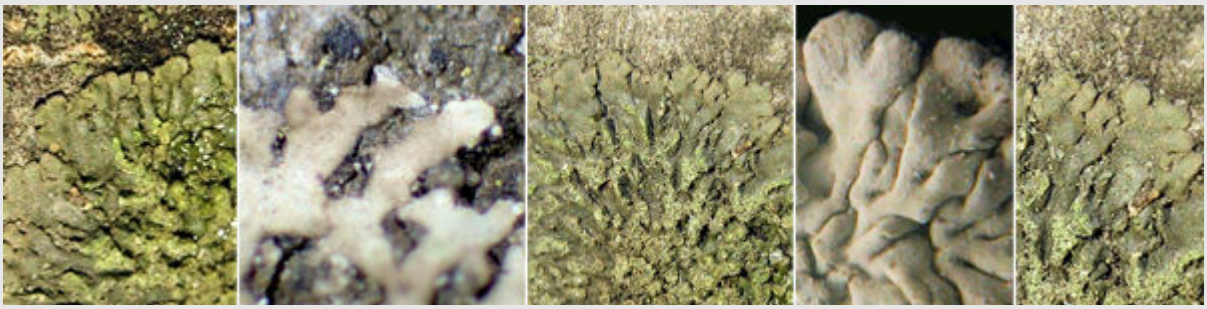
Narrow-lobed foliose thalli of *Physconia* and *Phaeophyscia*.



Narrow-lobed foliose thalli of *Pannaria* and *Fuscopannaria*.

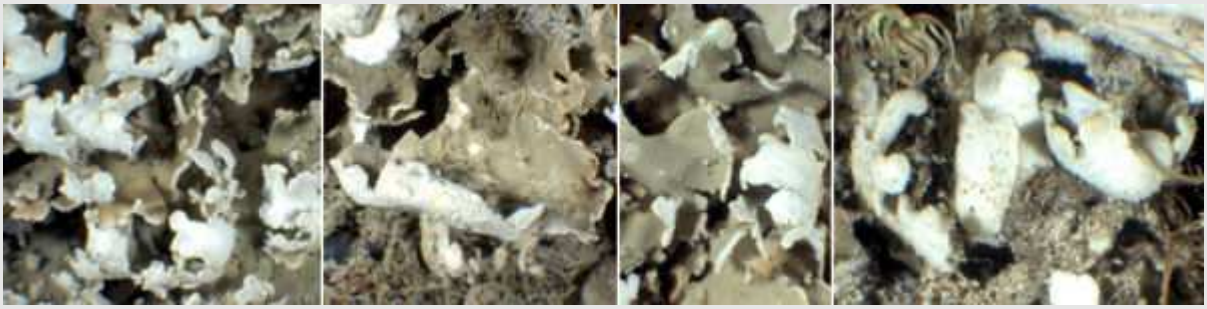
Inflated foliose thalli of *Hypogymnia*.

**Crustose lichens**: they develop in 2 dimensions just as foliose lichens, but the lower surface adheres completely to the substrate.



In some crustose species, the thallus is clearly lobed (placodioid).

**Squamulose lichens**: the thallus consists of small scales.



Squamulose primary thallus of *Cladonia* (see later).

Squamulose thalli of some *Leptogium* species.

**Leprose lichens**: these lichens are reduced to a soft mass of powdery granules which can be easily removed from the substrate.

**Gelatinous lichens**: this group includes both foliose and crustose species. They contain cyanobacteria and have an undifferentiated thallus (homoiomerous), that becomes highly gelatinous when wet.

**Compound lichens**: some lichens (especially those of the genus *Cladonia*) have 2 types of thallus, a primary thallus consisting of a mat of basal squamules, and erect fruticose structures (podetia) of various shapes.

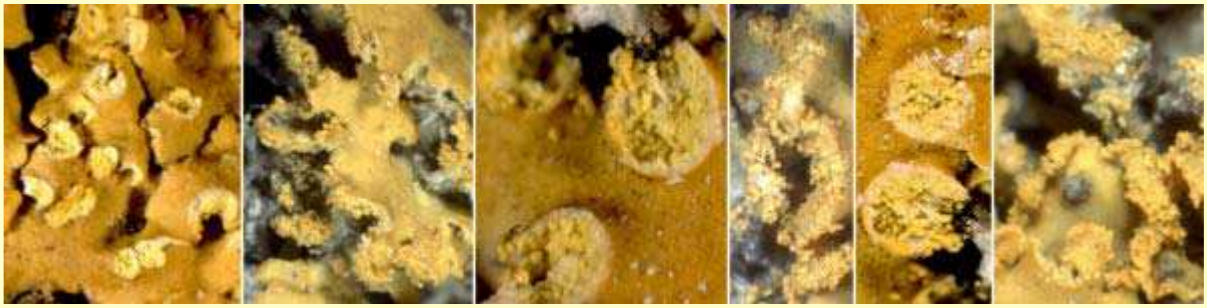
Simple to branched podetia of *Cladonia*.

Cup-shaped podetia of *Cladonia*.

## Colours

Lichens rarely have 'pure' colours. It is important to appreciate the terms used in our keys for describing the colours of lichen. When not otherwise specified, the colour should always be observed when the lichen is dry!

**Yellow** lichens.



**Orange** lichens.

**Yellowish-green** lichens.

**Grey** or **grey-green** lichens.

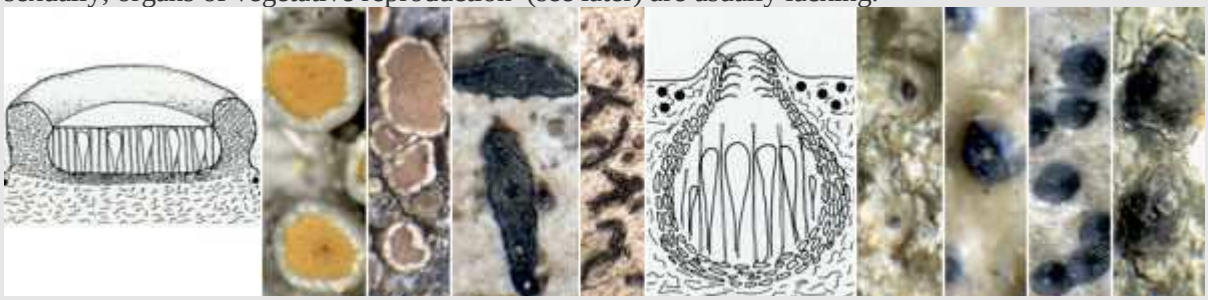
**Brown** lichens.

**Blackish** lichens.

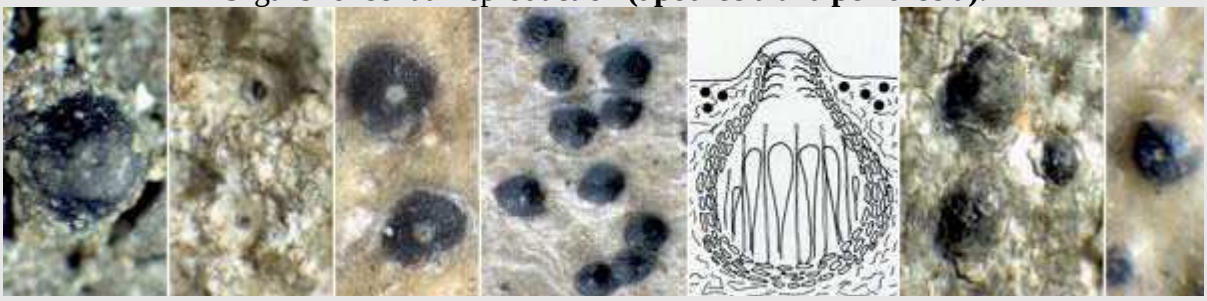
**Blue-grey** lichens (*Leptogium*).

## Organs for sexual reproduction

In the lichen symbiosis only the fungus is able to reproduce sexually. The organs for sexual reproduction (**perithecia** and **apothecia**) are therefore made by the fungus, and produce spores. When a lichen reproduces sexually, organs of vegetative reproduction (see later) are usually lacking.



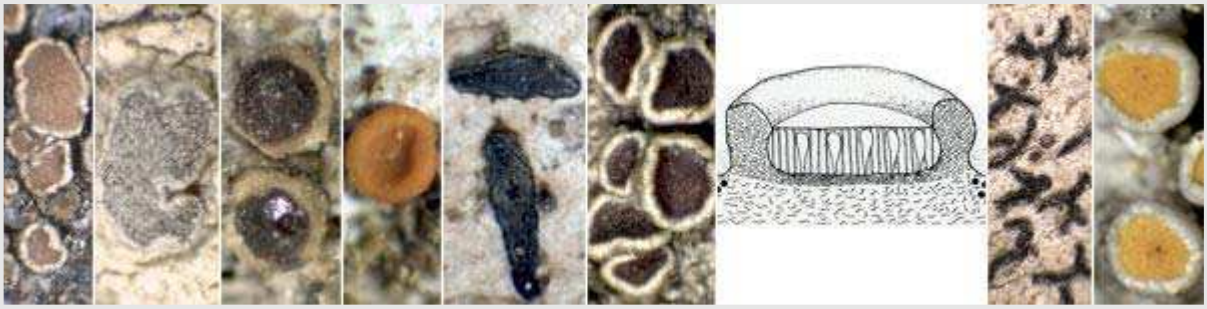
Organs for sexual reproduction **(apothecia** and **perithecia).**



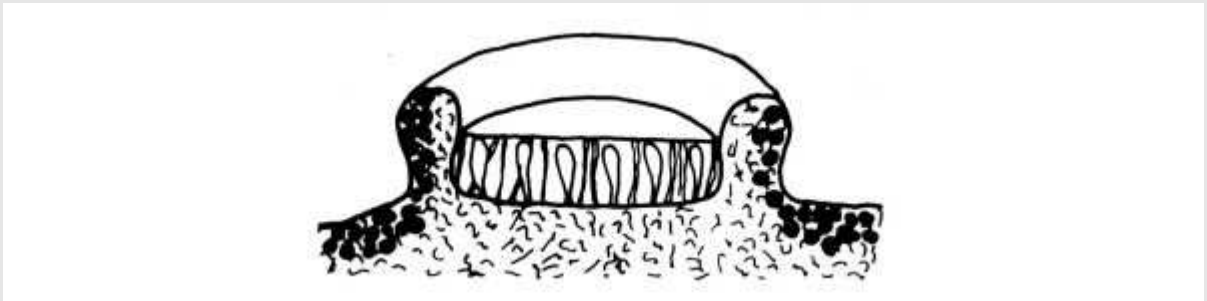
**Perithecia:** flask-shaped bodies with a small opening at the apex that releases the spores. In the following, we show some examples.

Pale-coloured perithecia.

Dark-coloured perithecia



**Apothecia:** bodies in which the spores are released from a surface exposed to the air. They have different shapes, but are usually disc-shaped. There are two major types of apothecia:



**Lecanorine apothecium:** the margin of the apothecium contains algae. Normally the disc and the margin have very different colours. In the following, we give some examples.

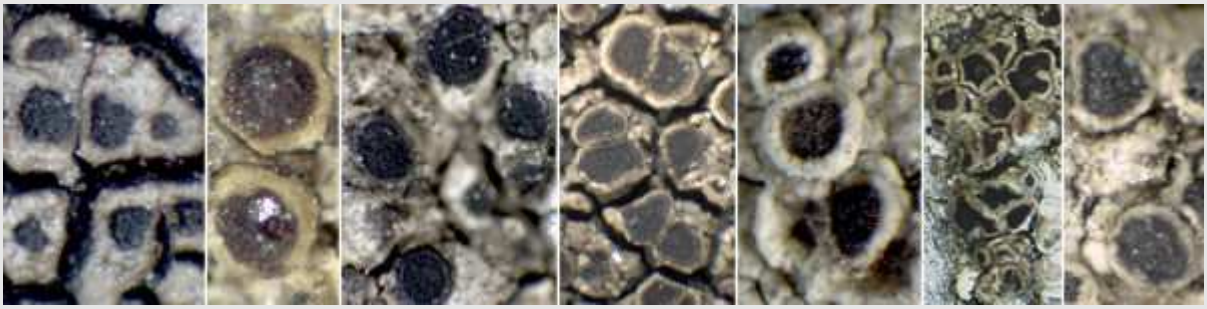
Different types of lecanorine apothecia.

Lecanorine apothecia of *Caloplaca cerina*.

Lecanorine apothecia of *Heterodermia*.

Lecanorine apothecia of *Lecanora*.

Lecanorine apothecia of *Xanthoria*.

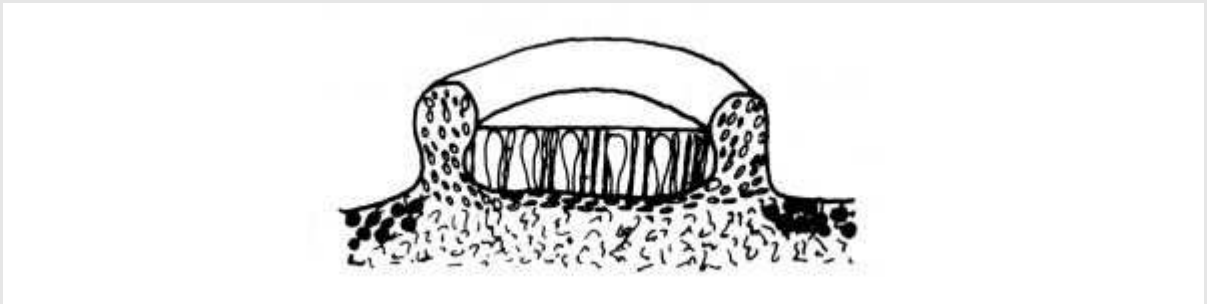


Lecanorine apothecia of *Rinodina*.

Lecanorine apothecia of *Ochrolechia*.

Lecanorine apothecia of *Ramalina*.

Lecanorine apothecia of *Usnea*.



**Non-lecanorine apothecium:** the margin of the apothecium does not contain algae. Normally disc and margin have a similar colour, or the margin is absent.

Different types of non-lecanorine apothecia.

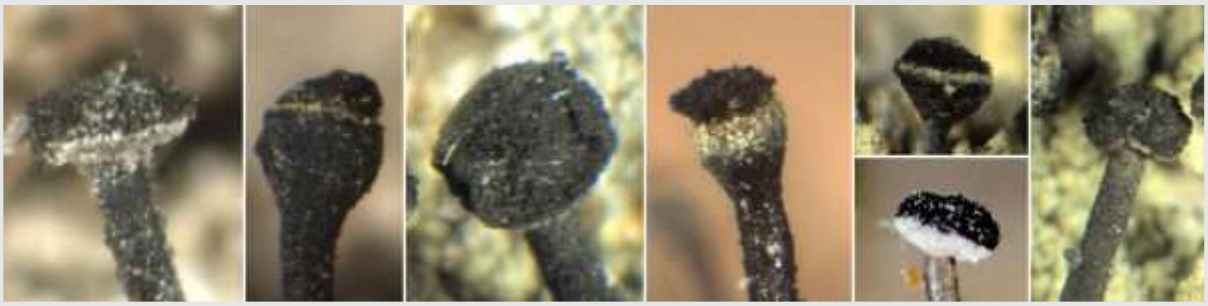
Red non-lecanorine apothecia of *Cladonia*.

Brown non-lecanorine apothecia of *Cladonia*.

Apothecia with a particular shape - **lirellae**: the apothecia are much longer than wide, sometimes branched (*Graphis*, *Opegrapha* etc.).

Apothecia with a particular shape - **lirellae arranged in a stroma** (*Glyphis* and *Sarcographa*).

Apothecia with a particular shape – **pin-like lichens**: in many Caliciales the apothecia are located at the top of long stalks. The asci produce an unlimited amount of spores, so that the apex of the 'pins' is covered by a mass of black, brown or greenish spores, called ***maezedium***. Some examples are provided below.

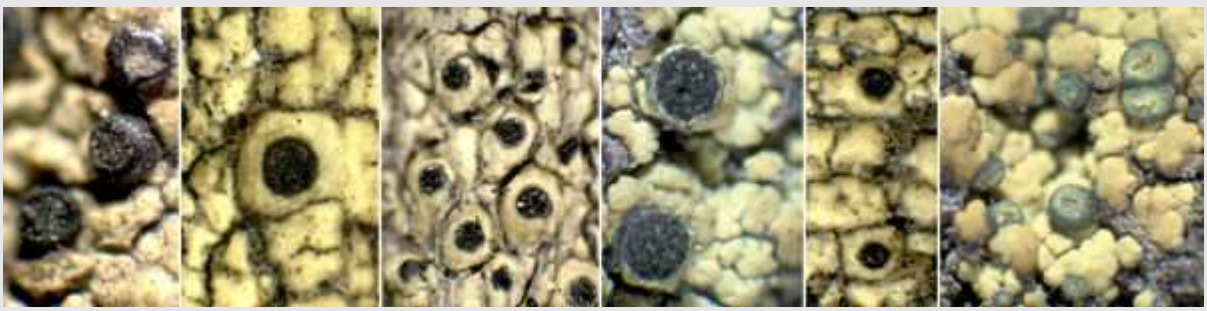


Black maezedium of *Calicium.*

Brown maezedium of *Chaenotheca*.

White pruina on the apothecia of Caliciales.

Yellow pruina on the apothecia of Caliciales.



Some Caliciales produce a maezedium but the apothecia are sessile (*Cyphelium*).

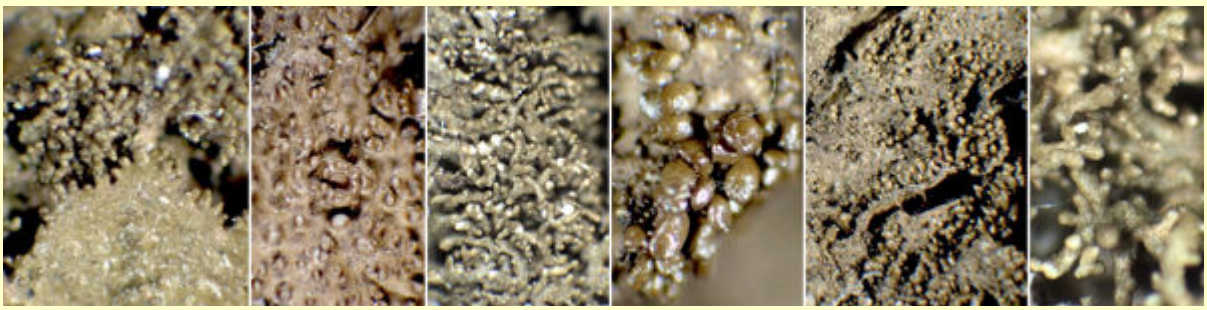
Apothecia with a particular shape – **saddle-shaped apothecia** of *Peltigera*: in this genus the apothecia are formed at the apex of lobes, and often resemble a saddle.

Apothecia with a particular shape – wart-like apothecia: the apothecia of most species of *Pertusaria* are immersed in thallus warts, that release the spores from a small apical pore. They can easily be confused with perithecia, which however are usually not covered by a thallus layer containing the photobiont.

## Structures for vegetative reproduction

Lichens can also reproduce as a whole lichen symbiosis. This can be done by vegetative propagules (isidia and soredia). When a lichen reproduces vegetatively, the organs of sexual reproduction are generally lacking (but there are exceptions).

**Isidia**: are protrusions from the upper surface of the thallus, covered by the cortex, which also contain cells of the photobiont. They are detached from the base, and are rather 'heavy'. Isidia can have different shapes (cylindrical, branched, flattened, granular etc.). In the following we provide some examples.

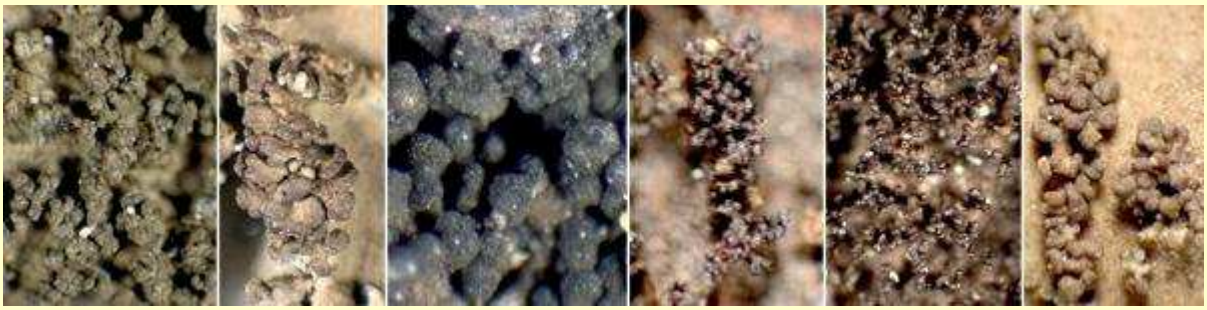


Isidia of *Melanelia*.

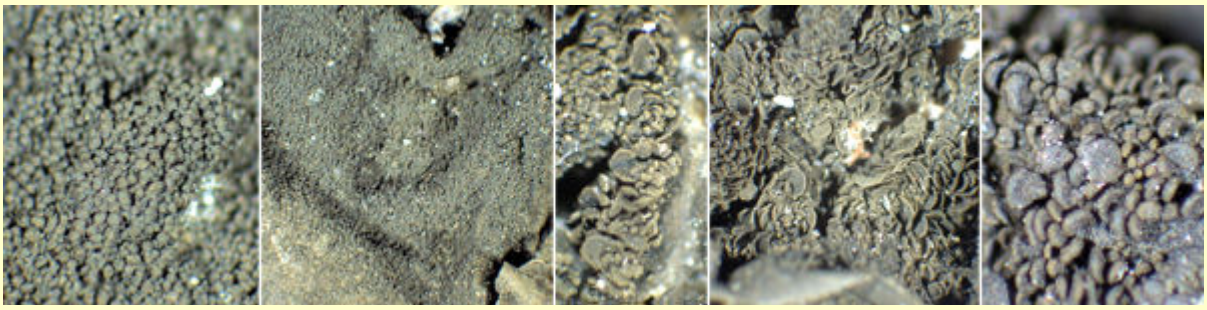
Isidia of *Parmelia saxatilis.*

Isidia of *Parmelia* s.l. and *Pseudevernia*.

Isidia of crustose lichens



Isidia of *Collema*.



Granulose isidia of *Collema*.

**Isidiomorphs** of *Usnea*: similar to isidia, they develop in groups inside the soralia of some species of *Usnea*.

**Soredia**: are tiny bundles of hyphae containing a few cells of the photobiont. They are much lighter than isidia and originate from the medulla. They look like a fine powder. Important is the way in which the soredia are located on the thallus (**soralia**). In the following we give some examples.

**Diffuse soredia**: they are formed on the entire surface of the thallus, so that the whole upper surface of the lichen looks powdery.

**Maculiform soralia**: the soredia are formed in well-delimited parts of the thallus (soralia) and have a circular shape.

**Labriform soralia**: formed in well-delimited parts of the thallus, usually at the tip of lobes, lip-shaped.

**Linear soralia**: the soralia are much longer than wide. They may be located on the surface of the thallus or along the edges of lobes.

Marginal soralia (*Cetrelia*).

Marginal soralia (*Sticta* and *Pseudocyphellaria*).

Soralia of *Ramalina* and *Evernia*.

In some species of *Ramalina* the soralia develop inside hollow portions of the lobes.

Well-delimited marginal soralia of *Parmotrema*.

Marginal soralia in a squamulose lichen (*Hypocenomyce*).

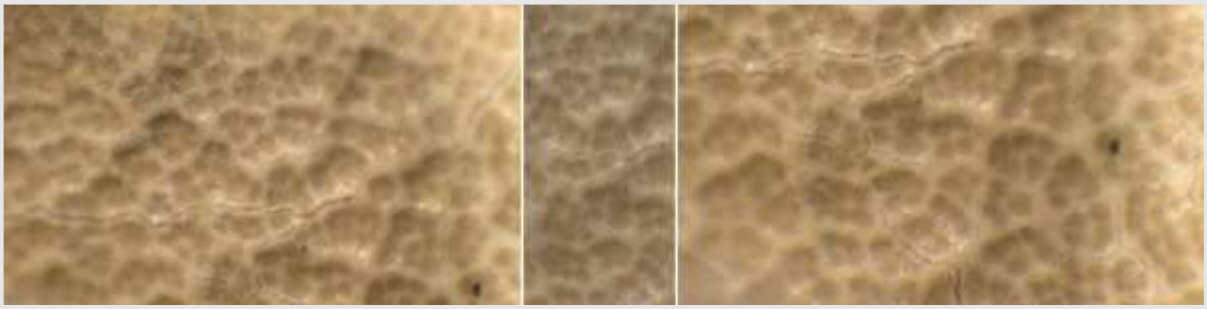
## Other structures

**Pseudocyphellae**: tiny interruptions in the upper cortex which expose the medulla. They appear as small lighter dots or lines, which are best visible at the apex of lobes. Some examples are given below.

**Punctiform pseudocyphellae**: small white dots from which maculiform soralia often originate.

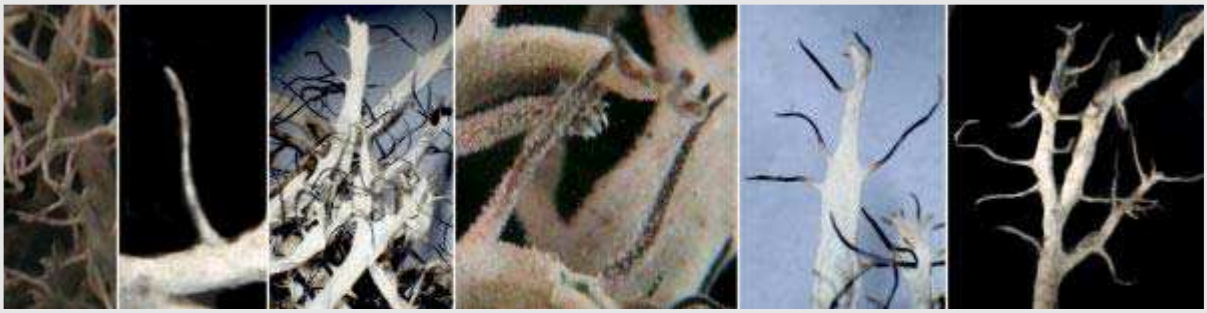
**Elongated pseudocyphellae**: small white lines, from which often linear soralia originate.

**Linear pseudocyphellae** of *Ramalina*.



**Reticulate pseudocyphellae** of *Parmotrema reticulatum*.

**Cyphellae**: large holes on the underside of the thallus in the genus *Sticta*, with a complex anatomy.



**Fibrils and cilia**: they are arranged at the edge of the lobes. They can be black , like in some species of *Heterodermia*...

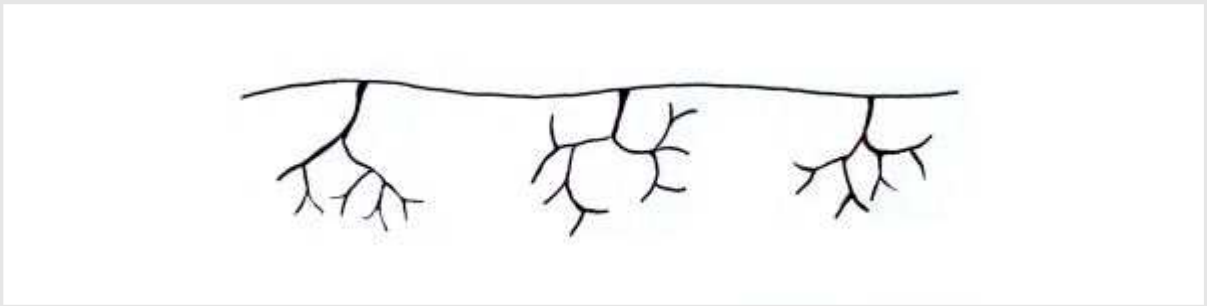
...and in some species of *Parmotrema*...

...or pale coloured (*Physcia*).

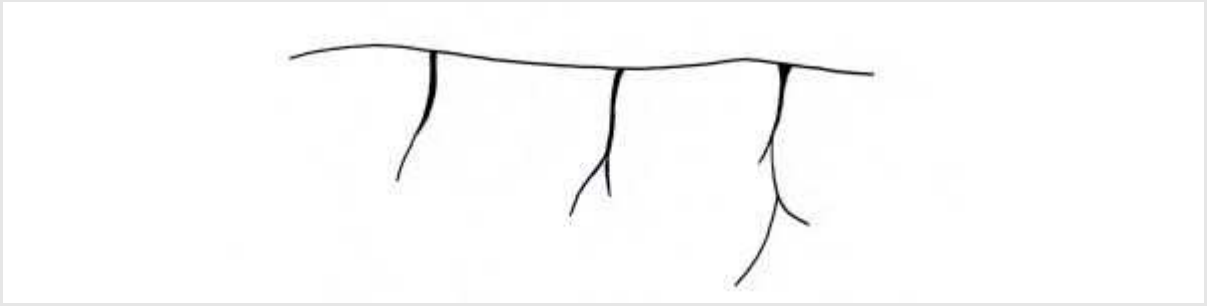
**Hairs:** thin transparent hairs, sometimes visible only with a strong magnifying glass.

**Rhizines:** rootlet-like structures that anchor foliose lichens to the substrate. Some examples are provided below.

**Bulbate rhizines** and cilia of *Bulbotryx*.

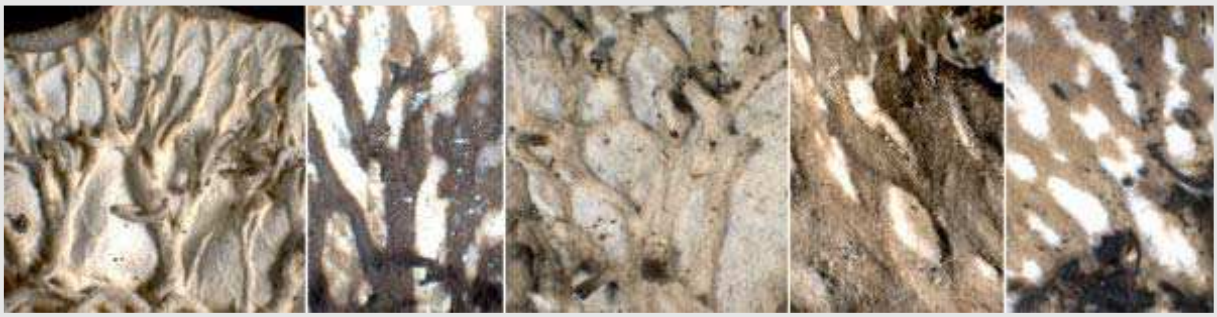


**Dichotomously branched rhizines** of *Hypotrachyna*.

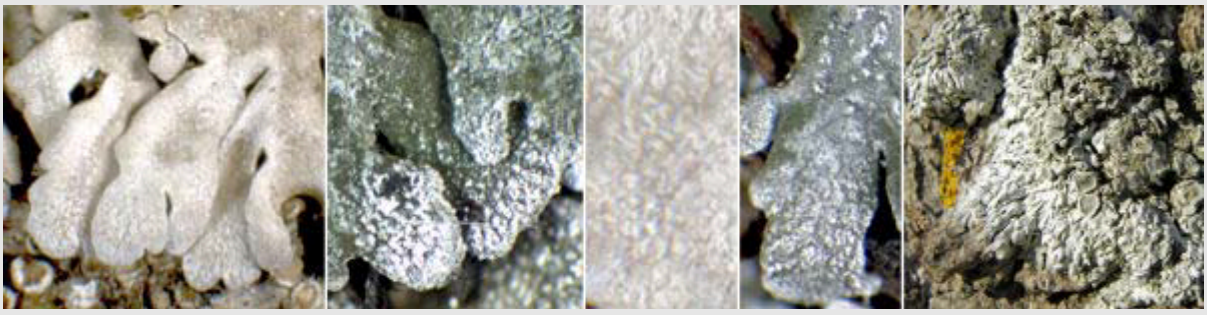


**Simple or irregularly branched rhizines**.

**Tomentum:** a dense layer of hairs on the underside of the thallus. Not to be confused with rhizines, that are much more robust.



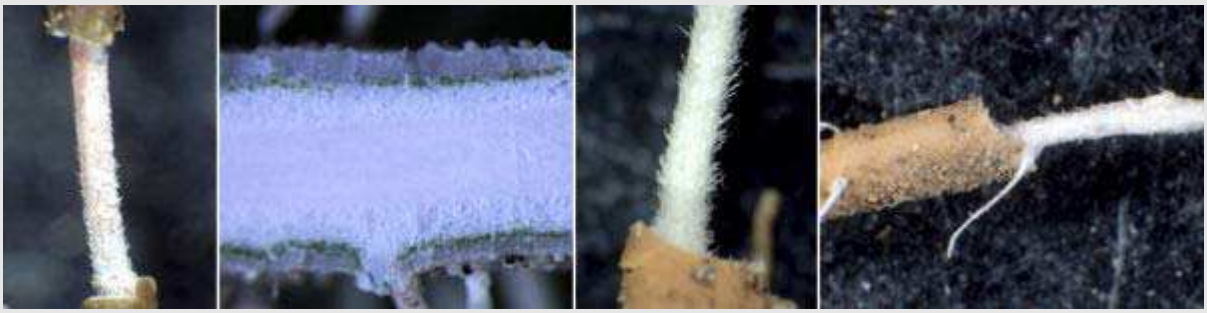
**Veins:** typical of the genus *Peltigera*, they are located on the underside of the thallus. They can be flat or raised, dark- or light-coloured.



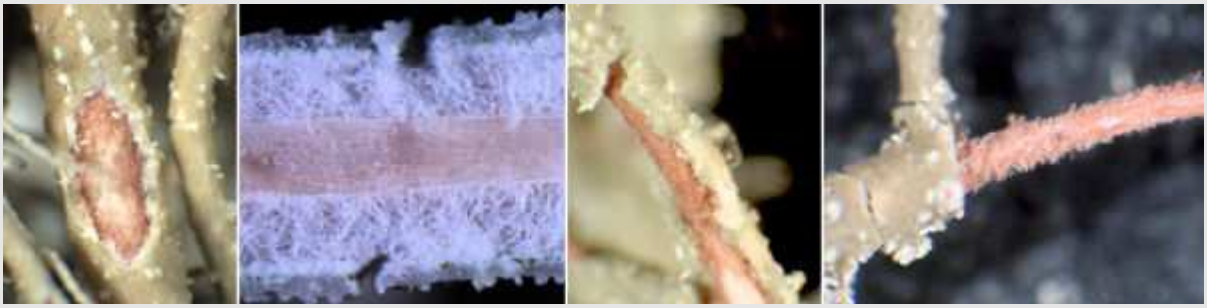
**Pruina:** crystal deposits on the surface of the thallus (usually white in colour), giving it a frosty appearance.

**Ridges:** the upper surface in some lichens is strongly ridged (e.g. in *Lobaria pulmonaria*).

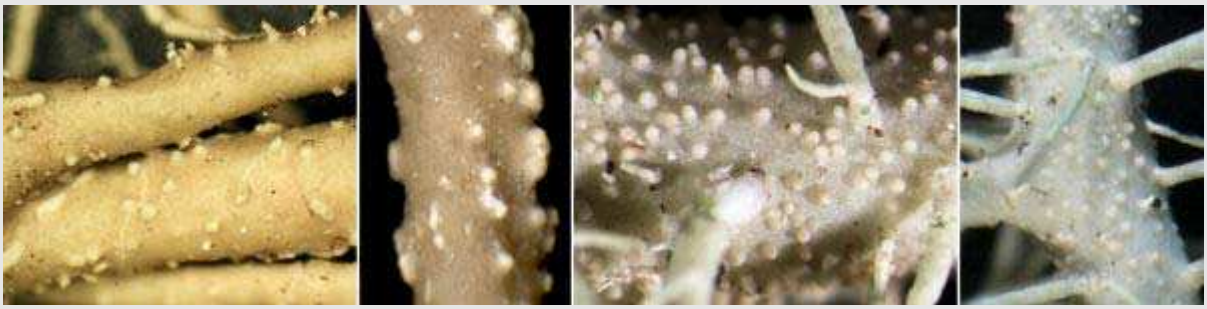
**Cephalodia:** dark, wart-like structures that contain cyanobacteria, which can be found on the thallus of lichens with green algae (typical of a few species, e.g. of some *Peltigera*).



**Central chord** of *Usnea*: In the genus *Usnea* the thallus is thread-like and the central part of the medulla forms a compact structure similar to a wire. It can be easily seen by stretching the branches.



The central chord of *Usnea* sometimes may be pink-coloured.



**Papillae and fibrils** of *Usnea*: structures similar to warts or wimpers, respectively, on the branches of some *Usnea* species.

**Pustules** are sometimes present on the upper surface of some lichens (e.g. *Collema*).

## Photobionts

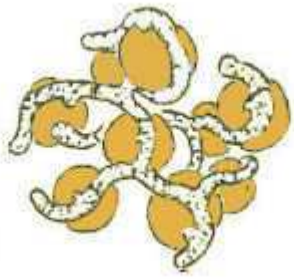
Lichens are in symbiosis with different types of photosynthetic organisms: green algae and cyanobacteria. The type of photobiont may be important for the identification. Here are some examples.

**Photobiont blue-green**, thallus **heteromerous**: the photobiont layer is blue-green (microscopic section!), the thallus is dorsiventral, dark-coloured and not gelatinous in the wet state.

**Photobiont blue-green**, thallus **homoiomerous**: the photobiont layer is blue-green (microscopic section!), the thallus is not dorsiventral, dark-coloured and gelatinous in the wet state.

**Photobiont chlorococcoid** (or trebouxioid): the photobiont layer is bright green, the lichen is not dark coloured in the wet state.

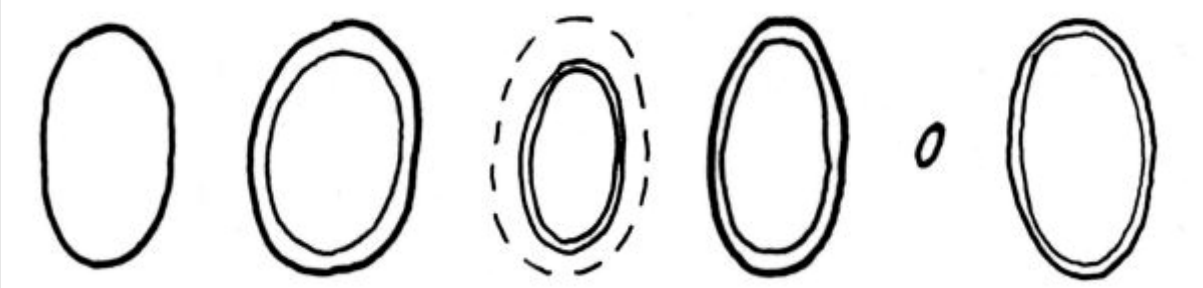
**Photobiont chlorococcoid**: the photobiont layer is bright green, the lichen is not dark coloured in the wet state.



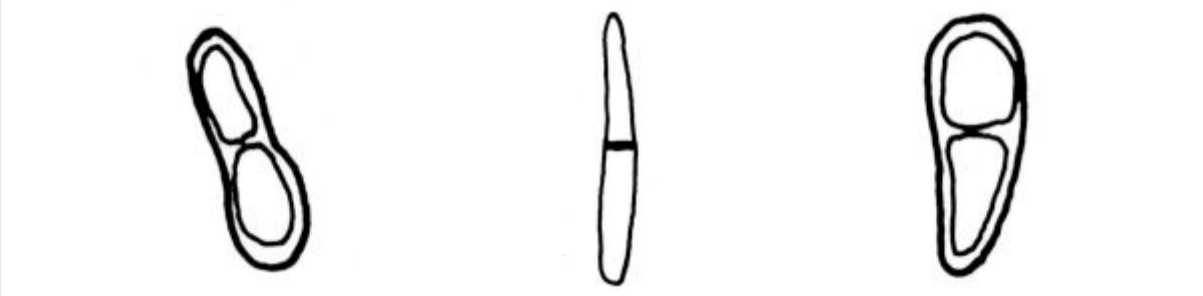
**Photobiont trentepohlioid**: the photobiont is a green alga which contains orange pigments, so that the photobiont layer (visible also by scratching the thallus) has a dirty orange colour.

## Spores

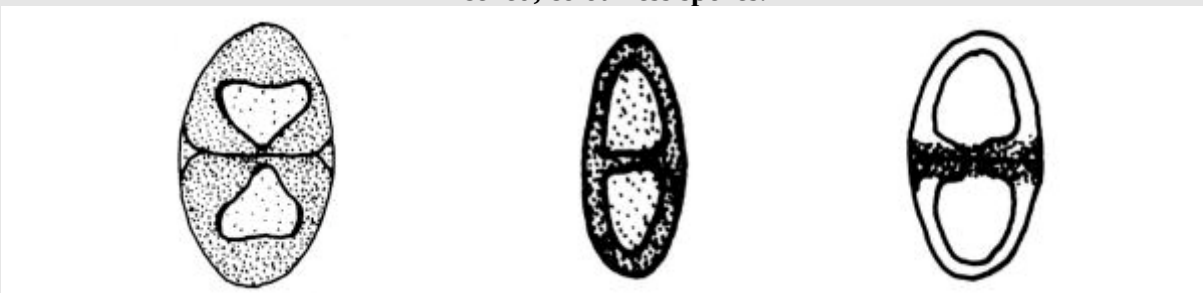
The observation of spores is often essential for the identification of lichens, especially crustose species. Important are shape, size, colour, cell number, and number of spores per ascus. Below is a brief overview of different types of spores.



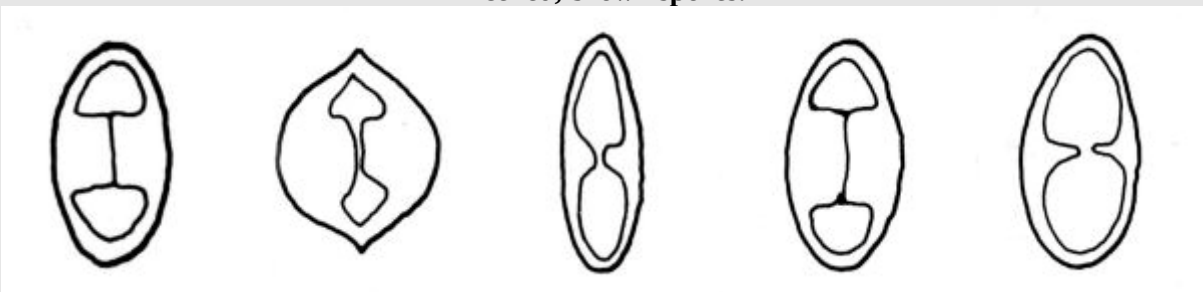
**Simple spores (1 cell only).**



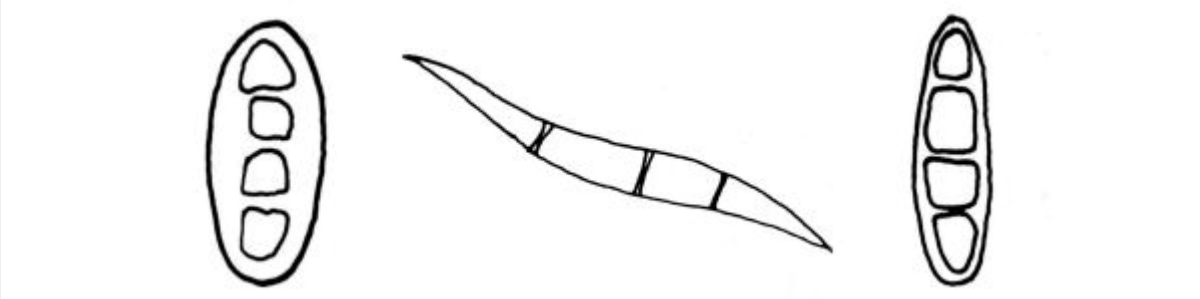
**2-celled, colourless spores.**



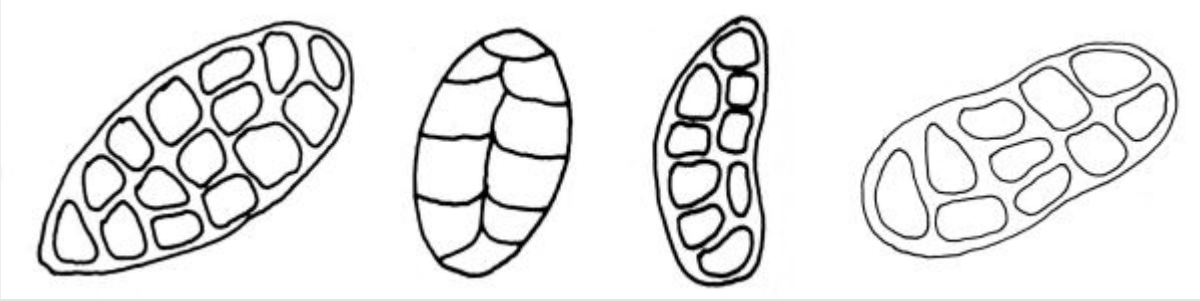
**2-celled, brown spores.**



**2-celled, polar-diblastic spores**: the two cells are connected by a thin canal.



**Multicellular spores with transversal septa only.**



**Muriform (wall-like) spores**: multicellular spores with both transversal and longitudinal septa.

## Spot tests

Many lichens contain chemical compounds, some of which have been used to make dyes, and others as sunscreen products. These compounds are also useful in identification, and we have included colour reactions for simple spot tests which can help you to identify some of these species. These spot tests are easy to do in the field and are described below.

**Spot tests:** simple spot tests have been used for many years to identify lichen substances that have a colour reaction. Note that a + denotes a positive colour reaction and a – indicates that there is no colour change. If you want to use the substances in the field you only need very small amounts (c. 20cc) which can be put in eye dropper bottles and kept in the fridge when not in use.

**Sodium hypochlorite (C)** is common bleach, the thin cheap variety without any additives is the best. Keep the bottle in the fridge if you want to use it repeatedly over several weeks. Avoid getting it on your clothes.

**Potassium hydroxide KOH (K)** or alternatively sodium hydroxide (NaOH - caustic soda) is used as a 10% solution in water. Care should be taken preparing this as it is highly caustic in the concentrated form.

Both these substances are applied as a small drop to the cortex, or to the medulla after scraping away the cortex. Record the colour reaction carefully and any change in colour that occurs.

**Paraphenylendiamine (P)** is not readily available except from a lab and is not recommended for use outside laboratory conditions. It is available as crystals and can be dissolved in alcohol in order to test the specimen. Alternatively it can be made into a stable solution for regular use called Steiner's solution. Instructions are available in most lichen identification books.

**Negative reactions**: the liquid /or the treated part of the lichen does not change colour (however, the surface may become more green).

**K+ yellow**: the liquid and/or the treated part of the lichen becomes yellow.

**C+ and KC+ pink reaction** of the medulla: this is often a very short-lasting reaction.

**C+ yellow reaction** of the apothecial discs in *Lecanora carpinea*.

# Glossary

(from P.L. Nimis & S. Martellos - *Keys to the lichens of Italy. I. Terricolous species*. Edizioni Goliardiche, Trieste, 341 pp., 2004, slightly modified)

**Acicular** (of spores): needle-like, very narrow and long, e.g. those of *Arthrorhaphis*.

**Acuminate** (of spores): pointed, with acute ends.

**Adglutinate** (of paraphyses): not easily detachable from each other, almost glued together.

**Adnate** (of apothecia): not restricted at the base.

**Adpressed** (of thallus): closely adhering to the substrate.

**Amyloid** (of asci, or thallus parts): reacting ***J***+ blue.

**Anastomosing** (of paraphyses): branched, the branches joining irregularly, forming a net; e.g. those of *Micarea*.

**Angiocarp** (of ascocarps): the ***hymenium*** is not exposed until the asci are mature. This term is not used in our keys. See also ***hemiangiocarp***.

**Anisotomic** (of thallus parts): dividing in unequal parts, with a division which is thicker or/and longer then the others; e.g. the branching of *Alectoria nigricans*. See also ***dichotomic, isotomic, tetrachtomous***, ***trichotomous***.

**Anticlinally** (of hyphae): the ***hyphae*** are arranged perpendicularly to the surface of the ***thallus***.

**Annular**: ring-like; like the structure which is present in the apical apparatus of some ***asci***.

**Apical**: located at the top. See also ***tholus***.

**Apothecia** (singular: apothecium): the fruiting bodies of ***discocarpic*** Ascomycetes, ***ascocarps*** where the ***hymenium*** is fully exposed to the air, usually forming a ***disc***, surrounded or not by a ***margin***. Depending on the type of margin, they may be ***lecanorine*** or non-lecanorine. Most apothecia have a more or less rounded form, with several exceptions: some (e.g. those of some *Pertusaria*) are ***perithecioid***, the disc being completely surrounded by the thalline margin, the spores being discharged by a narrow pore, others (e.g. in *Graphis*, *Opegrapha*, etc.) are elongated and ramified (***lirelliform***), etc.

**Arachnoid** (of thallus): a tissue of lax ***hyphae***, cottony in appearance.

**Areolae** (singular: areola): portions of crustose thalli divided by cracks or fissures. They may be contiguous or dispersed, rounded, angular, or elongate, flat or convex, etc.

**Areolate** (of thallus, or of cortex): disrupted into ***areolae.*** This term is often used also for the ***schizidia***-like structures present on the ***podetia*** of some Cladonias (e.g. in *Cladonia pyxidata*).

**Asci** (singular: ascus): sac-like structures within which the ***spores*** are formed. Important taxonomic characters at supraspecific level are the layers of the ascus wall (see ***bitunicate***, ***unitunicate***), and the structure of the ascus tip, which facilitates the dispersal of spores (see ***tholus***). These features - best observed under the microscope by applying ***J*** to a thin section, are rarely used in our keys, being rather difficult to appreciate - but they are often mentioned in the descriptions.

**Ascocarp**: the fruiting body of any Ascomycete, i.e. the structure in which the fungal partner produces the ***spores.*** See ***apothecia*** and ***perithecia.***

**Ascoma** (plural: ascomata): see ***ascocarp***.

**Ascospores**: see ***spores***.

**Aspicilioid** (of apothecia): ***lecanorine apothecia*** semi immersed in the thallus, the thalline ***margin*** not prominent, but containing algae in section; e.g. those of *Aspicilia calcarea*. See also ***cryptolecanorine***.

**Axil** (of podetia): the point where two ***branches*** diverge. In some species of *Cladonia* the axils are occupied by a hole (perforate axils).

**Axis**: the term mostly refers to the compact, filamentous medulla of *Usnea*-species (central axis, or central chord).

**Bacilliform** (of spores and spermatia): stick-shaped, narrowly cylindrical, the ends not acute.

**Biatorine** (of apothecia): ***apothecia*** "lacking a true ***exciple*** when mature, and which are pale or more or less coloured, soft in consistency, and generally strongly convex" (from Purvis et al. 1992). In other terms, a ***lecideine apothecium*** with a non-black ***margin***. This rather difficult term is not used in our keys, being subsumed under "non-***lecanorine***".

**Biseriate** (of spores): arranged more or less in two rows within the asci.

**Bitunicate** (of ascus walls): the ***ascus*** wall is composed of two layers (endo- and esoascus), which tend to separate at the time of dispersal of ***spores***: the more rigid outer wall breaks, the inner wall rapidly collapses. See also: ***fissitunicate***, ***unitunicate***.

**Blastidia:** propagules for the asexual reproduction of the lichen, produced by the budding of thalli in a yeast-like manner, with each new blastidium produced from the tip of the previous one; they are easily confused with ***soredia***, more rarely with ***isidia***; in our keys, they are mostly subsumed under "soredia".

**Branches**: parts of ramified fruticose lichens with a more or less circular section.

**Bullate** (of thallus parts): bubble-like, restricted at the base. Used esp. for squamulose lichens, e.g. the squamules of some *Toninia*, e.g. *T.toepfferi*.

***C*** (reagents): bleaching water solution (sodium hypochlorite) or undiluted commercial bleach. This reagent is short-lasting, it should renovated after ca. 10-20 days (more often in summer or in heated spaces). Reactions with ***C*** are sometimes ephemeral. Attention! Pure sodium hypochlorite - due to its odour - is becoming rare in supermarkets, being substituted by other products, some of which may give odd reactions!

**Canaliculate** (of thallus parts): channelled (e.g. the lobes of *Flavocetraria cucullata*).

**Capitate** (of soralia): ***soredia*** grouped into more or less convex knots, located at the end of lobes or branches (e.g. those of *Hypogymnia tubulosa*); the term is sometimes used also for ***paraphyses*** with distinctly swollen apical cells.

**Capitulum**: the spore-bearing, enlarged part of the pin-like apothecia of some Caliciales.

**Carbonaceous** (of parts of the ascocarps): coal-like, black, non-transparent, and friable (section!), such as the apothecial margins of *Opegrapha*.

**Cephalodia** (singular: cephalodium): lichenised structures containing cyanobacteria, found on thalli with a ***chlorococcoid*** main photobiont. They may appear as warts (e.g. *Peltigera aphthosa*), or as coralloid outgrowths (e.g. *Lobaria amplissima*) on the upper surface of foliose lichens, or as small warts on the pseudopodetia of fruticose lichens such as *Stereocaulon*. In some species they are scarcely visible, being immersed in the thallus (e.g. the internal cephalodia of some *Solorina*-species).

**Cerebriform**: folded like the human brain.

**Chlorococcoid** (of photobiont): one-celled green algae, excluding *Trentepohlia*: the photobiont layer has a bright green colour. See also ***trentepohliod***.

**Cilia:** human hair-like, stout outgrowths composed by several hyphae, usually arising from the edge of foliose thalli. (e.g. in *Parmotrema*), not to be confused with ***hairs***.

**Clavate** (of spores, or of asci): club-like, with one end thicker than the other.

**Coccoid**: more or less spherical.

**Concolourous**: of the same colour.

**Concrescent**: becoming jointed (e.g. of apothecia, of lobes, etc.).

**Confluent**: becoming merged (e.g. of soralia).

**Conglutinate** (of apothecial parts, esp. paraphyses): not easily detachable, almost glued together.

**Conidia** (singular: conidium): see ***spermogonia***.

**Conidiophorous** (of cells): fungal cells, usually located inside ***pycnidia***, which in various ways give rise to ***spermogonia***.

**Consoredia**: a term used only for some species of *Lepraria* and *Leproloma*, which have a thallus consisting of a mass of ***soredia***-like granules. It refers to the case in which the granules are fused into larger clusters.

**Constricted** (of spores): the width of the ***spore*** is shorter at the level of the ***septum*** than between septa.

**Constricted** (of apothecia): becoming narrow towards the attachment point, e.g. the apothecia of *Lecanora epibryon* as opposed to those of *Micarea adnata*.

**Coralloid** (of isidia, or thallus parts): coral-like, densely ramified, sometimes almost shrubby.

**Cortex**: the outer surface of thalli, when it consists of densely compacted and ordinately arranged hyphae. Several foliose lichens may have both an upper and a lower cortex. See also ***paraplechtenchymatous***, ***prosoplechtenchymatous***.

**Corticate** (of thallus parts): provided with a ***cortex***.

**Crenate-crenulate** (of thallus and thallus parts): with rounded marginal teeth.

**Crustose** (of thallus): crust-like, without lower ***cortex*** and ***rhizines***, attached to the substratum by a dense hyphal net, hence gas exchanges only possible through the upper surface. Crustose lichens can be only collected together with their substratum.

**Cryptolecanorine** (of apothecia): ***lecanorine apothecia*** more or less immersed in the thallus, the thalline ***margin*** not prominent (see also ***aspicilioid***).

**Crystals** (of anatomical sections): usually of oxalates. The presence and size of crystals in anatomical sections (esp. of apothecia) is important for identification in some groups (e.g. in some *Lecanora* species). They are best observed in thin sections under polarised light. The ***pruina*** is also mostly composed of small to coarse crystals.

**Cups** (in *Cladonia*): cup-like endings of ***podetia***. They generally bear ***apothecia*** and ***pycnidia*** at the margin; sometimes they are ***proliferating***, either from the margin or from the centre, giving rise to several stocks of superimposed cups.

**Cyanobacterial** (of photobiont): the ***photobiont*** is a Cyanobacterium. In section, it has a characteristic blue-green colour. Cyanobacteria belong to two main different groups: filamentous (thread-like, e.g. ***Nostoc***, ***Scytonema***) and coccaceous (several cells joined into a spherical structure, e.g. ***Gloeocapsa***). *Nostoc*, in particular, can occur in the typical form, with a thread-like, ***moniliform*** series of globular cells (e.g. in *Collema*), or in very short-chained forms, sometimes reduced to a series of a few cells only (e.g. in some small *Leptogium*-species).

**Cyphellae** (singular: cyphella)**:** like ***pseudocyphellae***, these are structures for facilitating gas-exchange, but have a more complex structure, with a layer of globular cells delimiting a gaping hole. The only lichens with cyphellae (more or less round openings in the lower surface) belong to *Sticta*.

**Diaspore:** a rather confusing term of the lichenological terminology, designating an**y**thing which can reproduce the lichen, including things like ***spores*** (sexual reproduction) and ***isidia*** (vegetative reproduction). See also ***propagule***.

**Dichotomous** (of thallus parts): branching into equal branches, as in the letter Y (see also: ***anisotomic***, ***isotomic tetrachtomous***, ***trichotomous)***.

**Diffuse** (of soralia): evenly spread through the thallus (e.g. those of *Phlyctis argena*).

**Disc** (of apothecia): the exposed upper surface of the ***hymenium*** in lichens with ***apothecia***.

**Discocarpic** (of mycobionts): lichenised fungi with ***apothecia.***

**Dorsiventral** (of thallus): with clearly different upper and lower surfaces.

**Effigurate** (of crustose thalli): with radiating marginal lobes, e.g. *Lobothallia radiosa*.

**Endolithic** (of thallus): completely embedded in the rock, incl. the photobiont layer (e.g. in most species of *Bagliettoa*, or in *Clauzadea immersa*). There are at least two types of endolithic lichens: some are typical of dry areas (deserts and semi-deserts, dry valleys in Antarctica, etc.), mostly on siliceous rocks, other occur on compact limestone. These two types differ considerably in morphology and ecology. See also ***endosubstratic***, ***hemiendosubtratic***.

**Endosubstratic** (of thallus): completely embedded in the substratum, incl. the photobiont layer, e.g. the thallus of *Bagliettoa parmigera*). See also ***endolithic***, ***hemiendosubtratic***.

**Epihymenium** (of apothecia): see ***epithecium***.

**Epilithic** (of thallus): growing above a rock surface (see also: ***endolithic***).

**Epinecral layer** (of thallus surface): an amorphous superficial layer consisting of the residues of dead cells, commonly present in several crustose lichens, both with and without a true ***cortex***.

**Epiphytic** (of thallus): growing on the bark of higher plants.

**Epispore:** the outer part of the ***spore*** wall, when this is thick, gelatinous or ***ornamented*** (e.g. with ridges, warts, etc.)**.**

**Epithecium** (of apothecia): the uppermost part of the ***hymenium***, formed by the usually pigmented upper cells of ***paraphyses***: it often has a distinct colour, and sometimes characteristic reactions useful for identification. It must be observed under thin microscopic sections.

**E-** (general suffix): without (e.g. ***epruinose***, ***ecorticate***, etc.).

**Ecorticate** (of thallus): without cortex.

**Endo-** (general suffix): lying inside something else.

**Endoascus** (of asci): see ***bitunicate*.**

**Ephemeral** (of thalli): of short duration.

**Epi-** (general suffix): lying above something else.

**Epicortex** (of thallus)**:** a term used only for *Parmelia* s.latiss., which designates a more or less amorphous layer lying above the upper ***cortex***. Never used in our keys.

**Epinecral** (of thallus): a layer of dead fungal cells covering the upper surface, with an amorphous appearance in microscopic sections.

**Epipsamma** (of apothecia): a term used for the ***epihymenium***, when this is granular, or rich in crystals. It is never used in our keys, but is sometimes present in the descriptions.

**Epruinose** (of thallus and apothecia): without ***pruina***.

**Eso-** (general suffix): lying outside something else.

**Esoascus** (of asci): see ***bitunicate*.**

**Excipulum** (sometimes deformed into "exciple", of ascocarps): the tissue(s) forming the ***margin*** of an ***apothecium***, or the walls of a ***perithecium***. In the case of apothecia, lichenologists often distinguish between an "*excipulum proprium*" (proper, or true exciple, formed only by the fungus) and an "*excipulum thallinum*" (thalline exciple, containing also the photobiont). In our keys the term "excipulum" may appear in the descriptions - in which case it is always used for anatomical features of the proper ***margin*** - and is not used in the dichotomies, being subsumed under ***margin*** for all lichens with ***non-lecanorine apothecia***. See also ***pyrenium***.

**Excipulum** (of ascocarps): see ***exciple***.

**Farinose** (of soredia, pruina): small and powdery, looking like meal. See also ***granulose***.

**Fasciculate** (of rhizines): with several, more or less parallel branches originating from the same point. See also ***squarrose***.

**Fibrillae** (singular: fibrilla): in *Usnea* these are short, simple branches perpendicular to the main ones; in foliose lichens this term is used for pale ***cilia*-**like structures on the margin of the lobes (e.g. in *Physcia adscendens*, *Anaptychia ciliaris*, etc.).

**Filamentous** (of thallus, or of cyanobacterial photobionts): thread-like (e.g. the thalli of *Alectoria*, *Bryoria*, *Ramalina thrausta*, *Usnea*, and those of *Nostoc* among photobionts).

**Fissitunicate** (of asci): ***bitunicate*.**

**Foliose** (of thallus): leaf-like, flattened, with an upper and lower surface, gas exchange occurring from both faces, usually attached by ***rhizinae***. Some lichens (e.g. *Anaptychia ciliaris* and *Pseudevernia furfuracea*) have a basically foliose, flattened thallus, which, however, tends to develop into three dimensions, and is not attached to the substratum by rhizines.

**Foveolate** (of thallus): with small, shallow depressions.

**Fruticose** (of thallus): developing in three dimensions, often shrub-like, and round to inflated in section, gas exchange occurring throughout the surface. See also ***foliose***, and ***squamulose***.

**Fusiform** (of spores): spindle-like, broader in the centre and narrowing towards the ends.

**Gelatinous** (of thallus - cyanobacterial lichens): becoming jellyish when wet (e.g. *Collema*). The cyanobacterial cells are surrounded by coats which tend to absorb liquid water, becoming jelly-like when wet. This character is easy to appreciate in some genera (e.g. *Collema*) in which the

photobiont is predominant, less easy in other genera, like *Leptogium*. See also ***homoiomerous***, ***heteromerous***.

**Glabrous**: without hairs.

**Glaucescent** (of colours): bluish-greenish grey.

**Globose**: spherical.

**Gloeocapsa:** a genus of ***cyanobacteria*** characterised, together with several other similar genera, by more or less spherical masses containing clusters of cells with a distinct, sometimes pigmented gelatinous coat. Most frequent in the Lichinaceae.

**Goniocyst:** more or less spherical groups of green algal cells surrounded by short hyphae, but without a true cortex (section!), forming a minutely-granulose thallus (e.g. in *Micarea*).

**Granules** (of thallus parts): thallus consisting of small, coarse, more or less spherical elements.

**Granulose** (of soredia): coarse, looking like ***granules***. See also ***farinose***.

**Hairs**: short, erect, transparent, hair-like structures, generally present on the upper cortex, and formed by a single ***hypha*** (e.g. in *Agonimia opuntiella*, *Phaeophyscia hirsuta*). See also ***cilia***, ***fibrillae***, and ***tomentum***.

**Halonate** (of spores): with a thick, transparent, gelatinous outer coat. See also ***perispore***.

**Hamathecium** (of ascocarps): a rather difficult, "neutral" term, which is never used in our keys, referring to all types of sterile ***hyphae*** (***paraphyses***, ***paraphysoids***, ***periphyses***, etc.) which occur in the ***hymenium***.

**Haustorium** (plural: haustoria): ***hyphae*** of the ***mycobiont*** which penetrate inside the cells of the ***phycobionts***.

**Hemi-** (general suffix): almost, partially.

**Hemiangiocarp** (of ascocarps): the ***hymenium*** is initially protected by a covering layer, which disrupts when the ***asci*** are ripe. Not used our keys. See also ***angiocarp***.

**Hemiendolithic** (of thallus): see ***hemiendosubtratic*.**

**Hemiendosubstratic** (of thallus)**:** embedded in the substratum, except the photobiont layer (e.g. *Caloplaca ochracea* as opposed to *Bagliettoa*-species). This character may be difficult to appreciate, and is used very rarely in our keys.

**Heterocyst** (of photobionts): a cell of filamentous ***cyanobacteria*** which differs from the others in the chain by its paler inner side and its thicker wall, devoted to nitrogen fixation. This term is never used in our keys.

**Heteromerous** (of thallus): having the ***mycobiont*** and the ***photobiont*** separated into well-distinct layers, usually ***dorsiventral***. See also ***homeomerous***, ***gelatinous when wet***.

**Homeomerous** (better: **homoiomerous**, of thallus): having the ***mycobiont*** and the ***photobiont*** evenly intermixed throughout the ***thallus*** (e.g. in *Collema*). See also ***gelatinous when wet***, ***heteromerous***.

**Hyaline** (of spores): transparent, colourless.

**Hymenial algae** (of lichens with ***perithecia***): green algal cells contained inside the ***hymenium*** of some groups of ***pyrenocarpous*** lichens (e.g. *Endocarpon*, *Staurothele*). They are often visible under a binocular, the sections of ***perithecia*** having a bright green core. These algae are often different in shape and size from those of the thallus.

**Hymenium** (of ascocarps, in section): the layer of tissue where ***asci*** arise and ***spores*** are produced. Its thickness, colour, and the reactions, esp. with ***J***, may be important in some groups. The thickness should be measured starting from the roots of the ***asci***, including the ***epihymenium***. See also ***thecium.***

**Hypha** (plural: hyphae): one of the filaments constituting the fungal ***mycelium***.

**Hypothallus**: marginal part of the ***thallus*** of ***foliose*** or ***squamulose*** lichens, composed only by the fungus, normally with a different colour and texture**.** In these keys, this term is often merged with ***prothallus*.**

**Hypothecium** (of apothecia): in our keys this terms refers indiscriminately to all tissues located below the ***hymenium***. Its thickness, reactions and esp. pigmentation may be important for identification. See also ***subhymenium***.

**Imbricate** (of thallus parts): overlapping, shingle-like, as the tiles of a roof, e.g. the squamules of *Mycobilimbia lurida*.

**Immersed** (of ascocarps and pycnidia): embedded in the substratum (e.g. the apothecia of *Clauzadea immersa*), or in the thallus (e.g. the perithecia of *Catapyrenium cinereum*).

**Inflated** (of thallus parts): swollen.

**Inspersed** (of the hymenium, in sections) **:** full of oil droplets which render it somehow milky, not transparent in a microscopic section.

**Involucrellum** (of perithecia): a usually black, lid-like structure originating from the upper part of the ***perithecium***, protecting the ***ostiole***. It can be best observed - often under a binocular - by vertically sectioning the perithecium. It is mostly limited to the upper part, but sometimes it extends until the base of the perithecium. Its presence may be important for identification (e.g. in *Catapyrenium s. lat.*, *Verrucaria*).

**Isidia** (singular: isidium)**:** structures for the vegetative reproduction of the lichen, which derive from swellings of the upper ***cortex***, and contain ***photobionts***. The true isidia are always ***corticate***, as opposed to ***soredia***. They may have different forms: erect and more or less round in section (simple or ramified-***coralloid***), or flattened (***spatulate, peltate***), etc. See also ***blastidia***, ***phyllidia***, and ***schizidia***.

**Isidiate** (of thalli): with ***isidia***.

**Iso-** (general suffix): equal, e.g. isodiametric = more or less round in shape, ***isotomic***.

**Isotomic** (of thallus parts): dividing in regular dichotomies into equal branches. See also ***anisotomic***, ***dichotomic, tetrachtomous***, ***trichotomous***.

***J*** (reactions): the typical ***Lugol***'s solution, which can be purchased by specialised furnishers: a water solution with 1.5% of Iod and 10% of KOH solution.

***K*** (reactions): a ca. 10% water solution of potassium hydroxide (KOH). It can be substituted with household lye (sodium hydroxide, NaOH).

***KC*** (reactions): the test is performed by wetting the tested area first with ***K***, then with ***C***. These reactions are often ephemeral. In most cases, the ***KC*** test enhances the results obtained with ***C*** only.

**Labriform** (of soralia): ***soredia*** originating from the lower face of lobes which tends to bent upwards, the ***soralia*** assuming a lip-like form (e.g. *Hypogymnia physodes*, *Phaeophyscia chloantha*).

**Laciniae** (singular: lacinia): flattened parts of ramified ***fruticose*** lichens (e.g. *Ramalina fraxinea*). Sometimes called ***lobes***.

**Laminal**: located on the upper surface of the thallus.

**Lax** (of medulla): loose, not compact.

**Lecanorine** (of apothecia): with a thalline ***margin*** containing ***photobionts***. In most cases, the colour of the margin is very different from that of the ***disc***. In some genera, however the colour is similar (e.g. in several species of *Caloplaca*), and one has to look for ***photobionts*** in microscopic sections. See also ***aspicilioid***, ***biatorine***, ***lecideine***, ***zeorine***.

**Lecideine** (of apothecia): having a ***margin*** exclusively consisting of dark-coloured fungal hyphae. This term is subsumed in our keys under ***non-lecanorine.*** See also ***biatorine***, ***lecanorine***, ***zeorine***.

**Leprose** (of thallus): a powdery mass of hydrophobic, ***soredia***-like granules. Some experience is needed to distinguish truly leprose thalli from crustose thalli with abundant, diffuse ***soredia***.

**Lichenised** (of mycobionts): always growing in symbiosis with a ***photobiont***. In certain groups, e.g. *Arthonia*, some species are clearly lichenised, others are clearly non-lichenised, (no true lichens), still others are of uncertain attribution.

**Linear** (of pseudocyphellae): when well-developed, narrow and elongated.

**Lirelliform** (of apothecia): a ***non-lecanorine apothecium*** with a long, narrow, elongate form (e.g. of *Graphis*, *Opegrapha*).

**Lobes** (of thalli): this term is used both for ***foliose*** and ***crustose*** lichens; it refers to flattened, elongate structures developed at the margin of the ***thalli*** (e.g. in *Squamarina lentigera*), or around the ***apothecia*** (e.g. in *Physconia venusta*). Their width should be measured in the central part. See also ***placodiomorph***.

**Lobulate**: with small ***lobes***.

**Lugol** (of reactions): see ***J.***

**Macroconidia** (singular: macroconidium): the larger ***conidium*** of a species that has more than one type of conidium (e.g. in some species of *Micarea*, or *Porina*).

**Maculiform** (of soralia): ***laminal soredia*** grouped into more or less round patches. See also ***punctiform***.

**Maezedium** (plural: maezedia)**:** a mass of ***spores*** liberated continuously by the ***asci*** of Caliciales. It appears as a powdery mass covering the ***apothecium***.

**Margin** (of apothecia): ***apothecia*** have two main types of margin: a) a ***proper*** margin consisting of fungal ***hyphae*** only; usually, the colour of the proper margin is similar to that of the disc and different from that of the thallus. b) a ***thalline*** margin, which includes ***photobionts***; usually of a colour similar to that of the thallus, and different from that of the disc (with several exceptions. e.g. in *Caloplaca*). In our keys, unless otherwise specified, the term "margin" always refers to the thalline margin for ***lecanorine*** apothecia, to the proper margin for ***non-lecanorine*** apothecia.

**Marginal** (of soralia): ***soredia*** limited to the marginal parts of thallus parts (usually ***lobes*** of ***foliose*** lichens).

**Medulla**: in section, this is the "central" part of the ***thallus***, located under the ***photobiont*** layer. It is composed exclusively by loosely arranged fungal ***hyphae***, the spaces between them facilitating gas exchange for the photosynthetic partner. It can be compact, loose or almost hollow, it can be ***pigmented*** or not, and it often contains lichens substances which are absent in the ***cortex*** (hence, it can have peculiar reactions, or a characteristic colour under a UV-lamp).

**Micareoid** (of photobionts): green algae with a diameter of 4-7 mm, thin-walled, often occurring in pairs (e.g. those of *Micarea*).

**Microconidia** (singular: microconidium): the smaller ***conidium*** of a species that has more than one type of conidium (e.g. in some species of *Micarea*).

**Moniliform** (of hyphae): arranged in a thread consisting in a series of globose cells, looking like a rosary, or the chains of *Nostoc*.

**Mycelium**: the tissue composed by the fungal part of the lichen, consisting of ***hyphae***.

**Mycobiont**: the fungal symbiotic partner in a lichen.

**Muriform** (of spores): looking like a brick-wall, many-celled, with many longitudinal ***septa*** and crosswalls. See also ***submuriform***.

**Non-lecanorine** (of apothecia): without a thalline ***margin***. See also ***biatorine***, ***lecanorine***, ***zeorine***.

**Nostoc:** a genus of ***cyanobacteria*** characterised by more or less long chains formed by a single row of rounded cells. In some genera (e.g. some *Leptogium* species) the chains are very short, consisting of a few cells only.

**Ocular chamber** (of asci): the ascus is ***bitunicate***, the two layers separate at the tip leaving an empty space (see ***tholus***), this space is concave with respect to the inner part of the ascus.

**Orbicular** (of thallus): more or less circular in shape.

**Ornamented** (of spores): spore ***wall*** not smooth. Ornamentation in some groups e.g. *Buellia* can be microrugulate, striate etc.

**Ostiole**: pore-like opening situated at the top of a ***perithecium*** or of ***pycnidia***, through which the propagules escape.

**Oval** (of spores): egg-like, the convex part lying more or less in the centre, symmetrical with respect the two axes.

**Ovoid** (of spores): see ***oval*.**

***P*** (reagents): Para-phenylendiamine in alcoholic solution (of short duration!). It is also possible to prepare ***P*** in water solution: e.g. 1 g of Para-phenylendiamine, 10 g of Natrium sulphate in 100 ml water. This substance, although still utilised e.g. for hair dying, might be carcinogenic. It should be used with great care (especially avoid to breath it under the microscope!). Teachers should not endorse its use by students, unless coupled with a lesson on the use of potentially dangerous substances, and with the corresponding measures.

**Paraphyses** (singular: paraphysis)**:** sterile ***hyphae*** in the ***hymenium***, forming a palisade within which the ***asci*** are interspersed. They may be simple or ramified, in some case they are ***anastomosing***; the upper cells, sometimes inflated and most often pigmented, form the ***epihymenium***. The true paraphyses always start from the base of the ***hymenium***. See also ***paraphysoids*** and ***periphyses***.

**Paraphysoids**: structures resembling paraphyses, but ontogenetically originating from the hymenial tissue between the ***asci***. They are usually thin, abundantly branched and ***anastomosing***, e.g. in *Arthonia*. In our keys, this term is sometimes used in the descriptions, being substituted by the term ***paraphyses*** in the dichotomies.

**Paraplechtenchymatous** (of sections): a fungal tissue (section!) consisting of more or less isodiametrical, rounded to angular cells. See also: ***plectenchyma***, ***prosoplechtenchymatous***.

**Parasitic**: this term is used here in a very broad, often incorrect sense: it refers both to truly parasitic fungi growing on lichens, and to the so-called "***parasymbiontic***" lichens, i.e. those which regularly start their life-cycle on other lichens, without being true parasites; in fact, having a photobiont layer, they are autotrophic; their "parasitism" probably consisting in "stealing" photobionts from the host lichen. More research is necessary to clarify the complex relations between "parasymbiontic" lichens and their hosts.

**Parasymbiontic**: see ***parasitic***.

**Parathecium** (of apothecia): proper ***margin***, formed only by fungal ***hyphae***. Not used in our keys, but sometimes present in the descriptions.

**Peltate:** plate-like, with a single attachment point from the centre of the lower surface.

**Periclinal** (of hyphae): parallel to the surface.

**Periphyses** (singular: periphysis): ***hyphae*** resembling ***paraphyses***, produced near the ***ostioles*** of ***perithecia***. They are mostly short and thin, hair-like. In our keys, this term only appears in the descriptions.

**Periphysoids:** this term is used by some authors to designate ***paraphyses***-like structures of ***pyrenocarpous*** lichens, developing from the upper part of the ***pyrenium***, and growing downwards. In our keys the term was not used consistently: it should be best regarded as a synonym of ***paraphyses***.

**Perispore** (of spores): a colourless gelatinous layer around ***spore***, visible in microscopic sections. See also ***halonate***.

**Perithecia** (singular: perithecium): globose to flask-like ***ascomata*** where the ***hymenium*** is enclosed within a "box" opening through a narrow apical pore at the summit, called ***ostiole***.

**Perithecioid** (of apothecia): opening through a pore, hence ***disc*** not evident and the whole structure resembling a ***perithecium*** (e.g. *Pertusaria pertusa*). In a few cases, it might be very difficult for a beginner to distinguish between a true perithecium and a perithecioid apothecium (e.g. in *Belonia russula*). In such cases, the species also appears in the keys among those having perithecia.

**Photobiont**: the photosynthetic partner of a lichen. In our keys three main types of photobionts are used for identification: ***cyanobacterial***, ***chlorococcoid***, and ***trentepohlioid***.

**Phyllidia** (singular: phyllidium): flattened structures resembling small lobes, formed by abstriction of a leaf-like part of the thallus, and serving for the vegetative reproduction of the lichen; they are sometimes difficult to distinguish from flattened ***isidia***; this term is used very seldom in our keys.

**Phyllocladia** (singular: phyllocladium): minute, granular, verrucose to coralloid, peltate to digitate parts of the thallus of *Stereocaulon*, bearing the ***photobiont***.

**Pigmented**: coloured, not white nor transparent in section.

**Placodioid** (of crustose thalli): ***orbicular***, with radiating marginal ***lobes***. A difficult, not indispensable term of the lichenological terminology.

**Placodiomorph** (of crustose thalli): see ***placodioid*.**

**Plectenchyma** (of thallus sections): a general term for all false tissues formed by the mycobiont only. See also ***paraplectenchymatous***, ***prosoplectenchymatous***.

**Pluricellular** (of spores): many-celled.

**Podetia** (singular: podetium): lichenised, fruticose structures of *Cladonia* and a few related genera, ontogenetically developing from a vertical extension of the lower apothecial tissues. Most of the *Cladonia* have two types of thallus: a primary, crustose to squamulose thallus, and the "podetia". However, a beginner might wonder whether the thalli of e.g. *Dactylina ramulosa* or *Thamnolia vermicularis* are "podetia" or not. As far as possible, we have tried to use this term only within *Cladonia*. See also ***pseudopodetia***.

**Polar-diblastic** (of spores): two-celled, the cells being connected by a narrow canal (most *Teloschistaceae*), whose length may be important for identification.

**Polymorphic**: of different forms.

**Primary** (of thallus parts): some fruticose lichens (especially *Cladonia*) have two types of ***thallus***: the primary one, ***crustose*** or ***squamulose***, gives origin to ***fruticose*** structures (***podetia*** and ***pseudopodetia***). In this book the term “primary squamules” exclusively refers to those of *Cladonia*, while the term “primary thallus” also refers to other genera in which ***podetia*** or ***pseudopodetia*** originate from a crust-like thallus (e.g. *Baeomyces*, *Stereocaulon*). The term “primary” has to do with the ontogeny of of thallus parts, non-primary structures (like ***podetia***) developing from the generative tissue of the ***apothecia***, a character which is of no use for identification.

**Proliferating** (of podetia): formed on the centre (e.g. in *Cladonia verticillata*) or on the margins (e.g. sometimes in *Cladonia pyxidata*) of ***cups***, giving rise to one or several stocks of ***podetia***.

**Propagule**: any structure serving to reproduce the lichen. Mostly used for those related to vegetative reproduction (***soredia***, ***isidia***, ***thalloconidia***, etc.). See also ***diaspore***.

**Proper** (of apothecial margin): see ***margin*.**

**Prosoplechtenchymatous** (of thallus sections): fungal tissue consisting of coalesced, more or less elongated hyphal cells; see also ***paraplectenchymatous***.

**Prothallus:** marginal part of the ***thallus*** of crustose lichens, composed only by the fungus, normally with a different colour and texture**.** In some cases (e.g. *Placynthium nigrum*) it is rather thick and felt-like, in other cases (e.g. *Rhizocarpon* species growing on quartz) it appears in the form of thin, branched bundles of hyphae exploring the substratum. See also ***hypothallus*.**

**Pruina**: powdery, frost-like deposits of crystals (often calcium oxalates), present on the ***cortex***, or on the ***ascocarps***; they may be very small and powdery, or aggregated into larger clumps; they are usually white, rarely of other colours (e.g. yellow in some *Caliciales*).

**Pruinose**: covered by ***pruina***.

**Pseudo-** (general suffix): resembling to something without being it (e.g. ***Pseudopodetia***).

**Pseudocyphellae** (singular: pseudocyphella): small interruptions of the ***cortex*** where the ***medulla*** is exposed to facilitate gas exchange. They may be linear-elongate (e.g. in *Parmelia sulcata*), reticulate (e.g. in *Parmotrema reticulatum*), punctiform (e.g. in *Punctelia subrudecta*). This character is important, esp. for foliose lichens, but is often difficult to appreciate for beginners (cracks in the cortex are often mistaken for pseudocyphellae).

**Pseudopodetia** (singular: pseudopodetium): in the dictionary of Fungi this term is defined as follows “*a lichenised, podetium-like structure of vegetative origin, ascogonia arising on this not on the pre-formed granular or squamulose thallus initials*”. The difference between podetia and

pseudopodetia has to do with their ontogeny (see ***primary***), and lies outside the scope of our identification keys. In the dichotomies, pseudopodetia are mostly subsumed under ***podetia***.

**Pubescent** (of thallus parts): covered by thin, short hairs.

**Pustula** (plural: pustulae): bubble-like swellings present on the thalli of some species (e.g. *Collema nigrescens*, *Lasallia*).

**Pustulate** (of thallus): covered by ***pustula****e*.

**Pycnidia** (singular: pycnidium): flask-like structures, resembling ***perithecia***, in which ***spermogonia*** are produced. They are mostly, but not always, dark-coloured, immersed in the thallus, appearing as small dots. Sometimes, however, they become prominent (e.g. in some *Micarea* species), and may have very different colours (from white to yellow-orange).

**Pycnidiospores**: see ***spermatia***. This term is never used in our keys.

**Pyrenium** (of perithecia): the ***wall*** of ***perithecia***. A term which is never used in our keys. See also ***excipulum***.

**Pyrenocarpic** (of mycobionts): lichenised fungi with ***perithecia***.

**Pyrenolichen**: a lichen with ***perithecia***.

**Pyriform** (of spores, perithecia): pear-shaped.

**Reniform** (of spores): kidney-like, curved.

**Reticulate**: net-like and interconnected (e.g. like the pseudocyphellae of *Parmotrema reticulatum*).

**Revolute** (of thallus parts): bent downward.

**Rhizines**: bundles of hyphae mostly originating from the lower ***cortex***, which anchor ***foliose*** or ***squamulose*** lichens to the substratum. Their shape and length may be important diagnostic characters in some genera (e.g. *Peltigera*). See also ***rhizohyphae***.

**Rhizohyphae**: individual hyphae, pigmented or colourless, which anchor the squamules of some lichens (e.g. *Catapyrenium* s.lat.) to the substratum. They should be not confused with ***rhizines***, which originate from the lower ***cortex***, and are stouter, being composed of thick bundles of ***hyphae***.

**Rimose** (of thallus): irregularly and minutely cracked, without distinct ***areolae***. A rather odd term, which is seldom used in our keys.

**Rosette-shaped** (of thallus): rounded in shape, symmetrical, mostly with radiating marginal ***lobes*** (e.g. *Squamarina lentigera*).

**Saddle-shaped** (of apothecia): used only for some *Peltigera*-species, those whose apothecia are elongated and curved, like the saddle of a horse (e.g. *P. polydactyla*), as opposed to those with flattened, horizontal apothecia (e.g. *P. horizontalis*).

**Scabrose** (of thallus surface): having a minutely roughened surface, generally caused by an accumulation of dead cortical material (e.g. *Peltigera scabrosa*).

**Schizidia** (singular: schizidium): structures for the vegetative reproduction of the lichen, deriving from the scale-like flaking of the upper cortex into flattened to convex ***areolae*** which are detached from the thallus. They have the same function as ***isidia*** and ***phyllidia,*** but they are ***corticate*** only above (e.g. *Cladonia pyxidata*, *Fulgensia subbracteata*).

**Scytonema** (of photobionts): a genus of filamentous cyanobacteria that branches by breaking through its gelatinous sheath.

**Secondary** (of thallus): see ***primary***.

**Semi-** (suffix): half, almost, e.g. semi-immersed = half immersed, almost immersed.

**Sessile** (of apothecia)**:** sitting on the thallus, more or less constricted at the base, never stalked.

**Septa** (of spores, singular: septum): cross-walls separating the individual cells of more than 1-celled spores; their thickness is an important character in some groups (e.g. in *Caloplaca*).

**Sessile** (of apothecia): not immersed, sitting on the surface, but without a stalk of any kind. See also ***stipitate***.

**Soralia** (singular: soralium): well-delimited parts of thallus where ***soredia*** are produced breaking the upper ***cortex***. They may be of different forms: ***punctiform***, ***maculiform***, ***labriform***, ***linear***, ***capitate***, ***helmet-shaped***, etc.

**Soredia** (singular: soredium): bundles of hyphae entwining a few ***photobiont*** cells, which serve to the vegetative reproduction of the lichen. They mostly originate from the ***medulla***, and appear as powdery or granular masses. See also ***blastidia***, ***soralia***.

**Spermogonia** (singular: spermogonium)**:** fragments of fungal hyphae produced in great number within ***pycnidia***. They may serve for vegetative reproduction (in which case they are best called ***conidia***), but their most probable role is that of acting as "male" cells for the sexual reproduction of the ***mycobiont*** of ascomycetes. Their dubious role is the reason of a confusing terminology: they are often called ***conidia***, ***pycnoconidia***, ***pycnospores*** (an odd term, which should not be endorsed: ***spores*** being the product of sexual reproduction). They may be one- or more-celled, and of very different forms and sizes. They are important in systematics, but they rarely appear in the dichotomies of our keys, because they are not always easy to observe. In some groups (e.g. *Micarea*) there are different types of spermogonia, whose different functions still await elucidation: see ***macroconidia***, ***microconidia***.

**Spores**: this term is the origin of much confusion in Mycology; it should be best used - as in our keys - exclusively for the sexual propagules of the mycobionts, which, in the majority of lichens, are produced inside the ***asci***. Spore characters (size, shape, number of cells, pigmentation, etc.) are important for identification. To appreciate all of them, one has to use a professional microscope.

**Squamulose** (of thallus): consisting of small, scale-like lobes lifting from the surface, at least at the edges. Among the traditionally recognised growth-forms, this is the most ambiguous. Typically squamulose is the primary thallus of most *Cladonia*-species, which consists of small, leaf-like units attached to the substratum only laterally, without rhizines or other attachment organs. However, the term is often used - also in our keys - also for and small-fruticose thalli (e.g. *Toninia opuntioides*). Due to the bad definition of the term, the distinction from crustose and subfruticose forms is often difficult to appreciate (e.g. in *Catapyrenium* s.str.). In our opinion, squamulose thalli in the strict sense - like foliose ones - should have both an upper and lower surface for gas-exchange, but should be attached to the substratum only laterally, without rhizines. In our keys we still stick to the old-fashioned, rather vague, traditional definition of the term.

**Squarrose** (of rhizinae): densely ramified, brush-like, with short, stiff perpendicular branches, having the appearance of a bottlebrush (e.g. in *Peltigera canina*).

***Stigonema*** (of photobionts): a genus of filamentous cyanobacteria having "true branching", resulting from perpendicular divisions of cells within the filament, found only in few cyanobacterial lichens (e.g. in *Ephebe*).

**Stipitate** (of apothecia)**:** brought on a peduncle**.**

**Sub-** (general suffix): partially, incompletely, approaching (e.g. ***submuriform***), or "lying under something else" (e.g. ***subhymenium***).

**Subhymenium** (of apothecia): in the strict sense, this is the part of the ***apothecium*** (visible in microscopic sections) which corresponds to the generative tissue below the ***hymenium***. In our keys, it is most often used as a synonym of ***hypothecium***.

**Submuriform** (of spores): weakly ***muriform***, with a few longitudinal septa only.

**Sulcate** (of thallus parts): furrowed, e.g. the surface of *Parmelia sulcata*.

**Taxon** (plural: taxa): any unit in a classification scheme (family, genus, species, subspecies, etc.).

**Terete** (of thallus, or thallus parts): round in cross-section (e.g. the branches of many *Usnea*-species).

**Terricolous** (of lichens): growing on soil.

**Tetrachotomous** (of thallus parts): 4-branched (e.g. in some species of *Cladonia*).

**Thalline** (of apothecial margins): the margin of ***lecanorine apothecia***, produced by the thallus and hence containing the ***photobionts***. Usually, the thalline margin has the same colour of the thallus, and differs in colour from the ***disc*** (e.g. in *Lecanora chlarotera*). Sometimes, however,

especially when the thallus is similar in colour to the disc (e.g. in some species of *Candelariella* and *Caloplaca*), a section is needed to reveal the photobiont in the margin.

**Thalloconidia** (singular: thalloconidium): structures serving to the vegetative reproduction of the mycobiont. They are very small and rounded, and consist of small clumps of hyphae, which are produced on the thallus, on the ***prothallus***. Rare, and limited to genera such as *Umbilicaria* (from the lower cortex), and *Protoparmelia* (e.g. *P. leproloma*, from the margin of areolae).

**Thalline** (of apothecial margin): see ***margin***.

**Thalloconidia**: small propagules for the vegetative dispersal of the ***mycobiont***, formed directly on the ***thallus***. They may be confused with ***soredia***, which, however, contain some cells of the ***photobiont***, while the thallonoconidia are formed only by the mycobiont.

**Thallus** (plural: thalli): the "body" of the lichen, formed by the myco- and the photobiont, excluding the parts devoted to sexual reproduction of the ***mycobiont (ascocarps)***.

**Thecium** (of ascocarps): a synonym of ***hymenium***. The parts lying above and under the hymenium are often called ***epihymenium*** and ***subhymenium***. The latter term, however, is rather ambiguous. The term *thecium* is never used in our keys, but we consistently call its upper and lower parts ***epithecium*** and ***hypothecium***.

**Tholus** (of asci): the apex of ***bitunicate asci***, when the two walls become distant from each other, giving the impression of an apical thickening. Its features, best observed after application of ***J***, are important for distinguishing among supraspecific ranks. They were rarely used in our keys, being often difficult to appreciate, but are mentioned in the descriptions.

**Tomentose** (of thallus): having a cover of soft, matted ***hairs***, best seen under a binocular microscope or a strong lens.

**Torus** (of spores): a thickening occurring near the septum of pluricellular spores, e.g. in *Rinodina*.

**Trentepohlioid** (of photobiont): a green alga related to *Trentepohlia*. The algal layer has a characteristic orange to greenish orange colour.

**Trichotomous** (of thallus parts): 3-branched, e.g. the thallus of *Cladonia portentosa*.

**Truncate** (of thallus parts): ending abruptly, e.g. the ***lobes*** of *Parmelia sulcata*.

**Umbilicate** (of foliose thalli): attached by a single, more or less central point (e.g. *Dermatocarpon*, *Rhizoplaca*, *Umbilicaria*).

**Umbonate** (of apothecia): provided with a column of sterile hyphae which protrudes from the ***hymenium*** in the form of a small, central wart (e.g. in *Lecidea umbonata*).

**Uniseriate** (of spores): in a single row within the ***ascus***.

**Unitunicate** (of ascus walls): the wall is composed of one layer only (a primitive character). See also: ***bitunicate***.

**Urceolate** (of apothecia): deeply concave, pitcher-like in form (e.g. in *Diploschistes diacapsis*). When young, urceolate ***apothecia*** may be confused with ***perithecia*** (see also ***perithecioid***).

**UV**: the colour of thallus or (mostly) of the medulla, as it appears under a UV lamp (in darkness). Protect your eyes with adequate spectacles, and be sure that the material on which you place your sample is not in itself reactive to UV (in principle, avoid white paper). Several UV-lamps permit the observation both under short- and long-wave radiation. Short-wave is the best for lichens.

**Veins** (of thallus): vein-like thickenings or flattened structures differing in colour from the lower surface of some foliose lichens, esp. in *Peltigera*. They are mostly very evident, and should not be confused with small foldings of the lower surface of foliose lichens.

**Verrucose** (of thallus): wart-like.

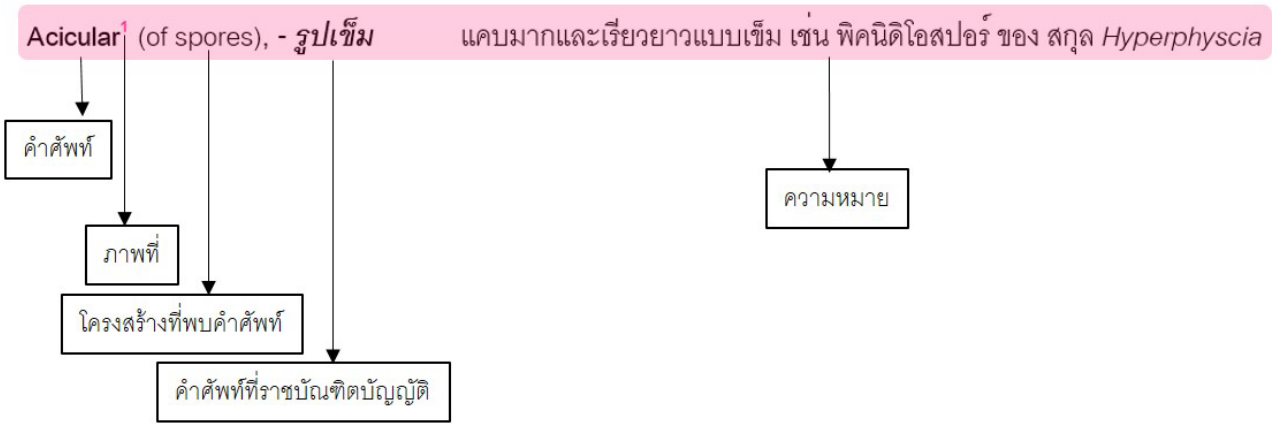
**Zeorine** (of apothecia): A lecanorine apothecium with a proper margin completely surrounded by a layer of photobionts reaching the lower part of the hymenium. This term is never used in our keys.

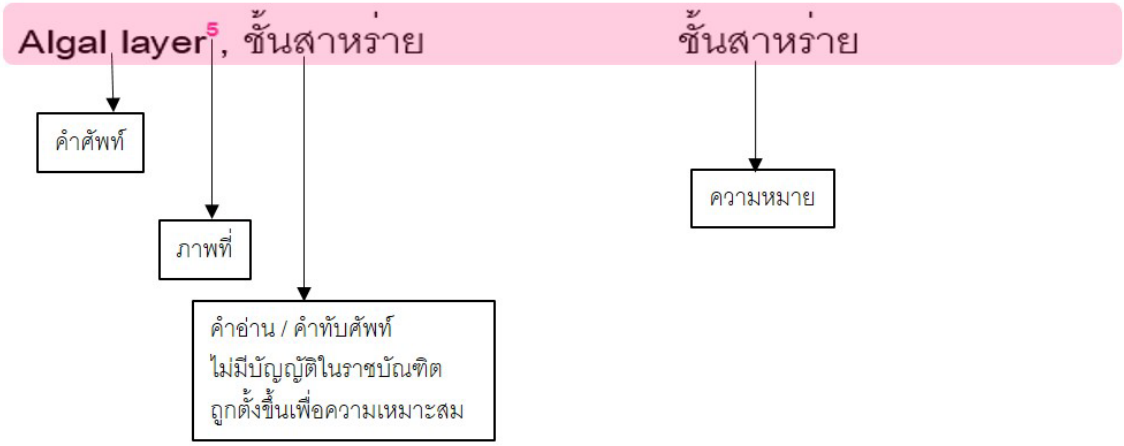
**Zonate** (of thallus): with concentric areas of different colour (e.g. in some forms of *Pertusaria amara*).

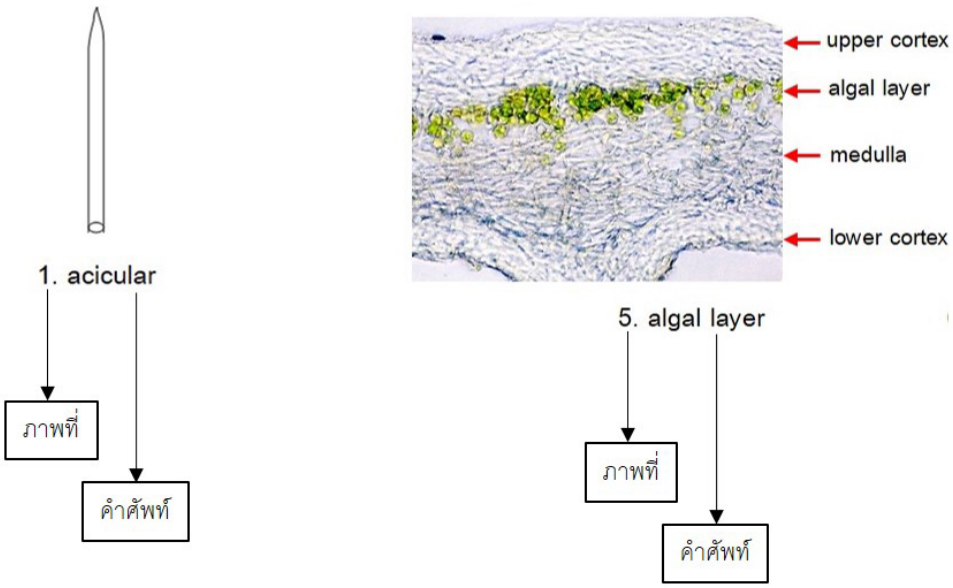
# อภิธานศัพท์

(Thai Glossary)

**คำแนะนำในการใช้อภิธานศัพท์**



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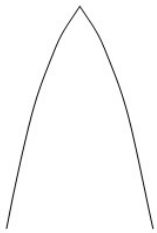
|---|---|
| A single cell layer | เป็นแถวชั้นเดียว |
| Acicular[1] (of spores), - ***รูปเข็ม*** | แคบมากและเรียวยาวแบบเข็ม เช่น พิคนิดิโอสปอร์ของ สกุล *Hyperphyscia* |
| Acuminate[2] (of spores), - ***เรียวแหลม*** | มน ปลายเรียวแหลม |
| Acute[3] | ปลายแหลม |
| Adnate[4] (of apothecia), - ***เชื่อมติด*** | เชื่อมติด/ติดแน่น |
| Adglutinate (of paraphyses) | ไม่สามารถที่จะแยกออกจากกันได้ง่าย หรือเกือบจะติดกันเป็นเนื้อเดียวกัน |
| Adpressed (of thallus), - ***แนบแน่น*** | เกาะติดที่อยู่อาศัยแนบแน่น (ใช้กับแทลลัส) |
| Algal layer[5], ชั้นสาหร่าย | ชั้นสาหร่าย |
| Allantoid[6] | คล้ายไส้กรอก (แอสโคสปอร์) งอเล็กน้อยปลายมน |
| Ampulliform | ทรงกระเปาะ |
| Amyloid[7] (of asci, ascospores) | ทำปฏิกิริยากับไอโอดีน (Iodine) แล้วเปลี่ยนเป็นสีน้ำเงิน |
| Anastomosis, - เชื่อมประสานกัน | เชื่อมประสานกัน เช่น ผนังเซลล์หรือเส้นใยราที่อยู่ชิดกันเชื่อมกันแล้วผนังเซลล์สลายไปทำให้เซลล์เชื่อมกัน |
| Angiocarp | แอสโคคาร์ปที่ชั้นไฮเมเนียมจะไม่เปิดออกจนกว่าถุงหุ้มสปอร์จะแก่เต็มที่ |
| Anastomosing[8] | เส้นใยราที่เชื่อมกันเป็นร่างแห |
| Anisotomic[9], แอนไอโซโทมิค | แตกแขนงอิสระ |
| Anticlinal, - ***ตั้งฉากกับผิว*** | โครงสร้างที่ตั้งฉากกับผิว เช่น เส้นใย (hyphae) ของรา |
| Annular, - รูปวงแหวน | ลักษณะคล้ายวงแหวน เป็นลักษณะที่พบได้บริเวณปลายของถุงหุ้มสปอร์บางชนิด |
| Apex, - ***ส่วนปลาย*** | ยอด/ปลาย |
| Apical cushion | บริเวณที่ไม่มีสีของยอดโดมในแอสคัส ที่อยู่ภายใน apical dome |
| Apical dome[10] (tholus) | บริเวณที่มีผนังหนาที่อยู่ส่วนปลายของแอสคัส |
| Apiculate[11], - ***เป็นติ่งแหลมอ่อน*** | ปลายมีติ่ง |
| Apothecia[12] (sing. apothecium), แอโพทีเชีย | โครงสร้างที่เกิดจากการสืบพันธุ์แบบอาศัยเพศ รูปร่างคล้ายถ้วยหรือรูปร่างยาวเรียว ทำหน้าที่สร้างสปอร์ อาจมีก้านชูหรือไม่มีก็ได้ |
| Arachnoid (of thallus) | ชั้นเนื้อเยื่อของราที่เส้นใยสานกันอย่างหลวม ๆ ลักษณะคล้ายปุยฝ้าย |
| Areolate, - ***ช่องร่างแห*** | ร่องร่างแห/แตกเป็นร่อง |
| Areole[13] (**หรือ** areola, pl. areolae), -***ช่องร่างแห*** | ลักษณะการแตกแยกเป็นส่วน ๆ คล้ายดินท้องนาที่แตกระแหงในฤดูแล้ง |

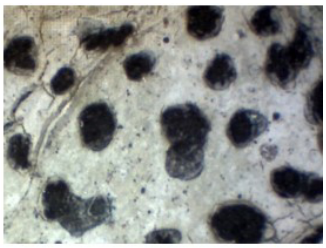
| | |
|---|---|
| Ascending, ตั้งขึ้น | ตั้งขึ้น ชี้ขึ้น |
| Ascocarp[14], แอสโคคาร์ป | โครงสร้างสืบพันธุ์แบบอาศัยเพศของราที่ภายในบรรจุถุง (ascus) สำหรับเก็บแอสโคสปอร์ (ascospore) ของราในกลุ่ม Ascomycota |
| Ascolocular, -ช่องในแอสโคคาร์ป | ใช้กับแอสโคคาร์ป ซึ่งถุงหุ้มสปอร์และสปอร์บรรจุอยู่ในช่องว่าง/โพรงที่ล้อมรอบด้วยเนื้อเยื่อ stroma |
| Ascoma (pl. ascomata), แอสโคมา | (ดู ascocarp) |
| Ascomycetes, แอสโคไมซีเทส | ราที่สร้างถุงหุ้มสปอร์ จากการสืบพันธุ์แบบอาศัยเพศ |
| Ascospores[15], แอสโคสปอร์ | สปอร์แบบอาศัยเพศที่ถูกสร้างขึ้นภายในถุงหุ้มสปอร์ ของราในกลุ่ม Ascomycota |
| Ascus[16], แอสคัส | ถุงหุ้มสปอร์ของราในไฟลัม Ascomycota |
| Ascus apex | ปลายถุงหุ้มสปอร์ |
| Aseptate[17], - ***ไม่มีผนังกั้น*** | ไม่มีผนังกั้น |
| Aspicilioid | แอโพทีเชียแบบมีสาหร่ายที่ขอบ กึ่งฝังจมลงในแทลลัส เช่น *Aspicilia calcarea* |
| Attenuate[18], - ***สอบ เรียว*** | ปลายเรียว |
| Axil | ตำแหน่งของโพดิเทีย (podetia) ที่สองกิ่งแตกออกจากกัน |
| Axis, ***แกน*** | แกน |
| Bacillar[19], “bacilliform”, รูปท่อน | รูปท่อน มีรูปร่างเป็นแท่งขนาดเล็กปลายกลมมน โดยมีความยาวและความกว้างในอัตราส่วน 3 : 1 |
| Basal holdfast, ฐานส่วนยึด | มีฐานที่ (อาจพองออก) ใช้ยึดกับที่เกาะอาศัย |
| Basidia (sing. basidium), เบซิเดีย | โครงสร้างรูปร่างคล้ายกระบองที่ส่วนปลายสร้างเบซิดิโอสปอร์ (basidiospore) เกิดจากการสืบพันธุ์แบบอาศัยเพศของรา กลุ่ม Basidiomycota |
| Basidiomycota, เบซิดิโอไมโคตา | ไฟลัมหรือดิวิชันของราที่สร้างเบซิดิโอสปอร์ (basidiospores) |
| Basidiospore, ***เบซิดิโอสปอร์*** | สปอร์ที่เกิดบนฐานรูปกระบอง (club shape) หรือ Basidia ของรา Basidiomycota |
| Basidium[20] (pl. basidia), ***เบซิเดียม*** | (ดู basidia) |
| Biatorine[21], ไบอะโทรีน | เป็นรูปแบบของ lecideine apothecia ที่ไม่มี exciple ที่แท้จริง เมื่อเจริญเต็มที่ ผิวนูนและสีของขอบแตกต่างจากสีผิวหน้าจาน (disc) |
| Bifurcate, - ***สองง่าม*** | สองง่าม แยกเป็นสองขีด |
| Bifusiform[22], กระสวยคอดกลาง | คล้ายรูปกระสวยแต่ตรงกลางคอด |
| Biguttulate[23], มีหยดน้ำมันสองหยด | มีหยดน้ำมัน 2 หยด |
| Bilocular[24], - ***มี 2 ช่อง*** | มี 2 ช่อง แบ่งเป็น 2 ช่อง |

1. acicular

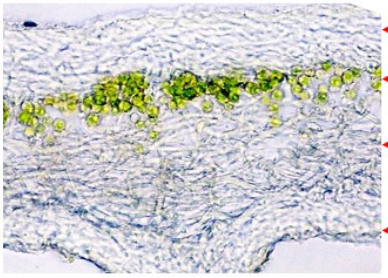
2. acuminate



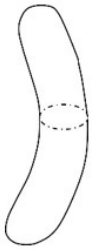
3. acute



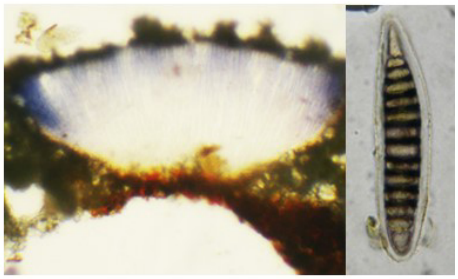
4. adnate



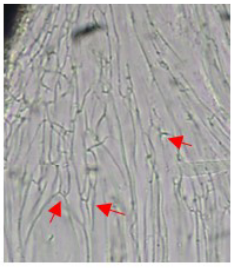

5. algal layer



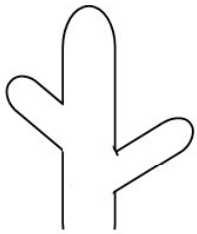
6. allantoid



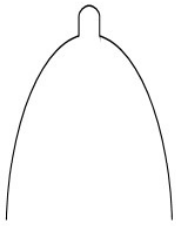
7. amyloid



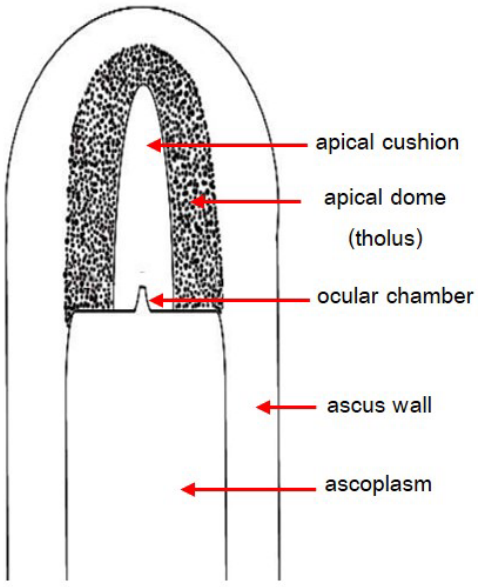
8. anastomosis



9. anisotomic

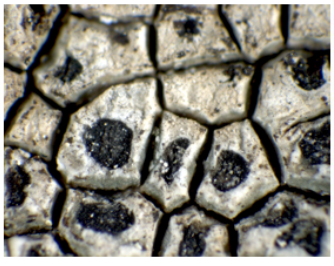


11. apiculate




10. apical dome

12. apothecia

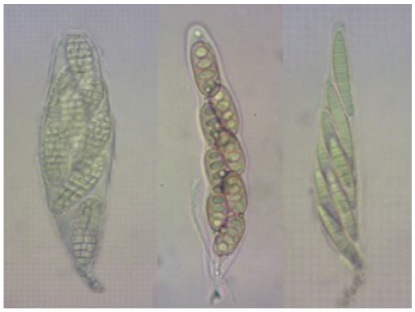


13. areole

14. ascocarps

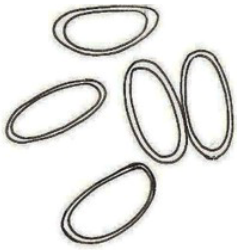
| | |
|---|---|
| Bipolar, - สองขั้ว | การมีสองขั้ว เช่น สปอร์ของราที่มีช่องภายใน (locule) เป็นกระเปาะที่ส่วนปลายทั้งสองข้าง |
| Biseriate[25], - ***เรียงสองแถว***, - ***เรียงสองชั้น*** | การเรียงตัวของสปอร์ เป็นแบบ 2 แถว ในถุงหุ้มสปอร์ |
| Bisporic[26], มีสองสปอร์ | ภายในหนึ่งถุงหุ้มสปอร์บรรจุ 2 แอสโคสปอร์ |
| Bitunicate[27] | ประกอบด้วยผนัง 2 ชั้น เช่น ผนังของถุงหุ้มสปอร์ |
| Blastidia | โครงสร้างกระจายพันธุ์แบบไม่อาศัยเพศเกิดขึ้นจากการแตกหน่อของแทลลัสลักษณะคล้ายกับการแตกหน่อของยีสต์ ทำให้เกิดความเข้าใจผิดว่าเป็น ซอรีเดียหรือไอซิเดีย |
| Branches[28], กิ่ง, แตกกิ่ง | ส่วนของแทลลัสที่เกิดจากการแตกกิ่ง (คล้ายรากฝอย) ของไลเคนในกลุ่มฟรูติโคส |
| Blue-green algae[29], ***สาหร่ายสีเขียวแกมน้ำเงิน*** | สาหร่ายสีเขียวแกมน้ำเงิน (Cyanobacteria, Blue-green algae) ที่อยู่อาศัยร่วมกับราในไลเคน |
| Bottle-shape[30], - *รูปขวด* (of pycnidium) | รูปร่างเป็นขวด เช่น pycnidia |
| Bulbate cilia[31], ขนเซลล์ฐานป่อง | ขนเซลล์ที่ฐานบวมเป็นกระเปาะ/ซิเลียฐานกระเปาะ |
| Bullate | ส่วนของแทลลัสที่ลักษณะหยักย่นหรือพองบวม เกิดขึ้นบริเวณฐานของไลเคนกลุ่มสแควมูโลส เช่น *Toninia toepfferi* |
| Byssoid[32], บิสซอยด์ | เส้นใยสานตัวกันอย่างหลวม ๆ บริเวณขอบของแอโพทีเซีย |
| Byssoid lichen[33], บิสซอยด์ไลเคน | ไลเคนที่แทลลัสประกอบด้วยเส้นใยของราประสานกันแบบร่างแหมองดูด้วยตาเปล่าคล้ายสำลี |
| Calcareous, ***มีหินปูน*** | โครงสร้างที่ประกอบขึ้นด้วยหินปูน (แคลเซียม) แข็งเป็นหิน |
| Campylidiospores, แคมไพลิดิโอสปอร์ | สปอร์สืบพันธุ์แบบไม่อาศัยเพศกำเนิดจากแคมไพลิเดียม |
| Campylidium[34], แคมไพลิเดียม | โครงสร้างสืบพันธุ์แบบไม่อาศัยเพศ ลักษณะเป็นแผ่นใบตั้งขึ้นเหมือนหูใบ |
| Canaliculated | ส่วนของแทลลัสที่มีลักษณะเป็นร่อง เช่น โลปของ *Flavocetraria cucullata* |
| Canopy lichen | ไลเคนที่เรือนยอด |
| Capillary, ***หลอดเล็ก*** | หลอดเล็กแบบเส้นเลือดฝอย |
| Capitate[35], - *ปลายโป่ง* | เป็นแท่งส่วนหัวป่องคล้ายไม้ขีด |
| Capitulum | โครงสร้างให้กำเนิดสปอร์ของแอโพทีเซียรูปร่างคล้ายเข็มในกลุ่ม Caliciales |
| Carbonaceous (of colour) | สีดำเหมือนถ่าน |
| Cell, เซลล์ | โครงสร้างและหน่วยทำงานที่เล็กที่สุดของสิ่งมีชีวิต |

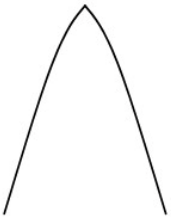
15. ascospores



16. ascus

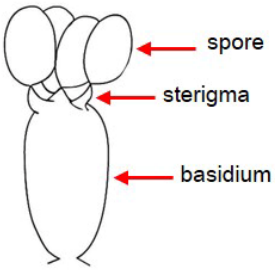
17. aseptate





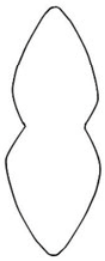
18. attenuate

19. bacillar



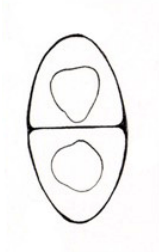

20. basidium

21. biatorine



22. bifusiform

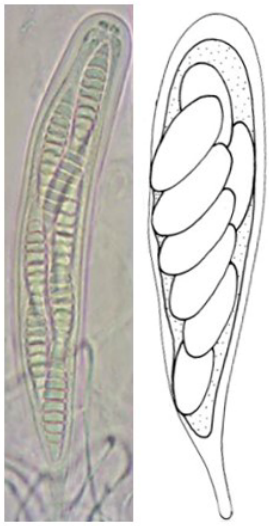
23. biguttulate



24. bilocular

25. biseriate

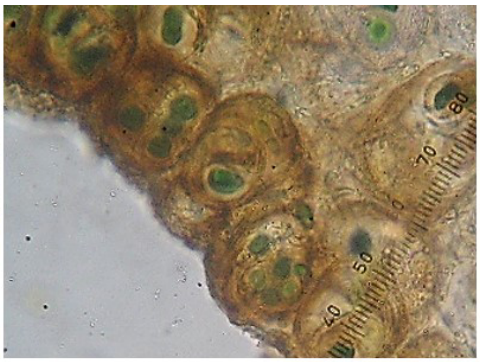
26. bisporic



27. bitunicate

| | |
|---|---|
| Cellulose | คาร์โบไฮเดรต (carbohydrate) ประเภทพอลิแซ็กคาไรด์ (polysaccharide) พบได้ในผนังเซลล์ของราในไลเคน และพืช |
| Cephalodium (pl. cephalodia), เซฟาโลเดียม | เป็นส่วนหนึ่งของแทลลัสที่พองออกมาคล้ายหูดที่ผิวหน้าหรือผิวล่างของชั้นเมดัลลา ภายในบรรจุสาหร่ายสีเขียวแกมน้ำเงิน (Cyanobacteria) |
| Cerebriform | รอยพับย่นลักษณะคล้ายสมองของมนุษย์ |
| Chemotaxonomy, ***เคมีอนุกรมวิธาน*** | การใช้สารเคมี (สารธรรมชาติ) ที่สิ่งมีชีวิตสร้างขึ้นมาในการจำแนกพันธุกรรม |
| Chemotype, เคโมไทป์, แบบทางเคมี | มีลักษณะภายนอกคล้ายกันแตกต่างกันที่สารเคมี |
| Chlorococcoid (of photobiont) | สาหร่ายสีเขียวที่เป็นเซลล์เดี่ยว ๆ รูปกลม (ไม่รวมสกุล *Trentepohlia*) เมื่อเรียงตัวเป็นชั้นมีสีเขียวสว่าง |
| Chlorophyte[36] | สาหร่ายสีเขียว |
| Chomophyte[37], ***พืชชะง่อนหิน*** | พืชที่ขึ้นระหว่างซอกหิน |
| Chromatography, โครมาโทกราฟี | เทคนิคที่ใช้ในการแยกสารประกอบหลายชนิดที่ปนกันอยู่ เช่น สารธรรมชาติชนิดต่าง ๆ (จากไลเคน 1 ชนิด) |
| Chroodiscoid (of photobiont) | สาหร่ายเซลล์เดียวสีเขียว (ยกเว้นสกุล *Trentepohlia*) เมื่อเรียงตัวเป็นชั้นมีสีเขียวสว่าง |
| Cilia[38], ***ขนเซลล์***, ซิเลีย | เส้นใยราที่มีลักษณะเป็นเส้นสีขาวถึงสีดำ ลักษณะคล้ายขนตา ขึ้นอยู่ที่ขอบของแทลลัส หรือแอโพทีเซีย |
| Cirrate, ***ม้วน*** | ม้วน |
| Clavate[39], - ***รูปคล้ายกระบอง*** | รูปกระบอง |
| Coccoid | รูปร่างกลมหรือค่อนข้างกลม |
| Columella[40], คอลิวเมลลา | โครงสร้างที่มีลักษณะคล้ายแท่ง อยู่กึ่งกลางของโครงสร้างสืบพันธุ์แบบอาศัยเพศ |
| Concave[41], - *เว้า* | เว้า |
| Concentric ridge, เส้นเป็นรัศมี | สันที่นูน เป็นริ้วคลื่นรอบวง |
| Concolourous | มีสีที่เหมือนกัน |
| Concrescent | การมาเชื่อมรวมกันของแอโพทีเซียหรือโลป เป็นต้น |
| Confluent | การบรรจบกันหรือการรวมเข้าด้วยกันของซอรีเดีย เป็นต้น |
| Conglutinate | ไม่สามารถแยกออกจากกันได้ง่ายหรือเกือบติดกัน เช่น การเชื่อมกันของพาราไฟซิส |
| Conical[42], ***-รูปกรวย*** | รูปกรวย |
| Conidia[43], โคนิเดีย (sing. conidium) ดู spermogonia | สปอร์สืบพันธุ์แบบไม่อาศัยเพศของราที่เจริญอยู่ในพิคนิเดียม หรืองอกจากเส้นใยโดยตรง พบในรากลุ่ม Ascomycota และ Basidiomycota |

28. branches



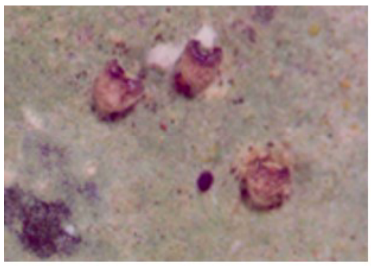
29. blue-green algae

30. bottle-shape (pycnidium)

31. bulbate cilia

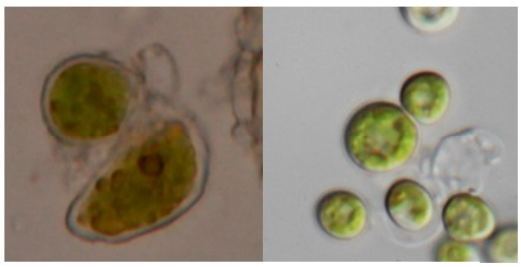
32. byssoid

33. byssoid lichen



34. campylidium

35. capitate

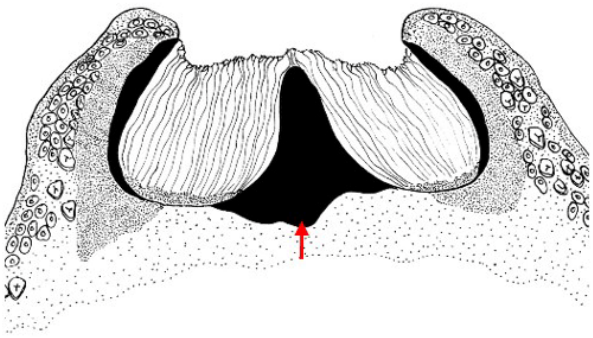


36. chlorophyte

37. chomophyte

38. cilia

39. clavate



40. columella

| | |
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| **Conidiophore**[43], โคนิดิโอฟอร์ | ก้านชูสปอร์ (แบบไม่อาศัยเพศ) ของรา |
| **Consoredia** | ซอรีเดีย (โครงสร้างสืบพันธุ์แบบไม่อาศัยเพศ) ปริมาณมากอยู่รวมเป็นกลุ่มก้อน กระจุกพบในสกุล *Lepraria* และ *Leproloma* |
| **Constricted** (of spores) | สปอร์ที่มีความกว้างสั้นกว่าผนังกั้นตามขวาง |
| **Constricted** (of apothecia) | แอโพทีเชียที่ด้านบนมีขนาดใหญ่และค่อย ๆ เรียวเล็กลงไปทางด้านล่างที่เกาะติดกับแทลลัส เช่น แอโพทีเชียของ *Lecanora epibryon* |
| **Convex**[44], - นูน, โค้ง | นูน |
| **Coralloid**[45] | ไอซิเดียหรือส่วนของแทลลัสที่ลักษณะการแตกกิ่งคล้ายปะการังหรือพุ่มไม้ขนาดเล็ก |
| **Coriaceous, - *คล้ายแผ่นหนัง*** | คล้ายแผ่นหนัง |
| **Corona**[46], ***-กะบังรอบ/มงกุฎ/คอโรนา*** | เช่น กระบังล้อมรอบแอสโคมาหรือขนเซลล์รอบแอสโคมาในไลเคน สกุล *Relicina* |
| **Cortex**[47], ***คอร์เทกซ์*** | ผนังส่วนนอกของแทลลัสประกอบด้วยเส้นใยของราอัดกันแน่น |
| **Corticated**, มีคอร์เทกซ์ | สร้างเนื้อเยื่อชั้นคอร์เทกซ์ |
| **Crenate *หรือ* crenulate** (of thallus) | แทลลัสหรือส่วนของแทลลัสที่ขอบมนหยักแบบฟัน |
| **Crustose**[48], ครัสโตส | แทลลัสที่เกาะติดแน่นกับที่อาศัย ไม่มีคอร์เทกซ์ชั้นล่างและไรซีน |
| **Cryptolecanorine** (of apothecia) | แอโพทีเชียชนิดมีสาหร่ายที่ขอบ (lecanorine apothecia) ซึ่งค่อนข้างฝังจมลงในแทลลัสทำให้เห็นขอบไม่ชัด (ดู aspicilioid) |
| **Crystal**[49], ผลึก | ผลึกแคลเซียมออกซาเลท (calcium oxalate)<br>ขนาดของผลึกที่พบในแอโพทีเชียหรือแทลลัสตามขวาง<br>มีความสำคัญในการจำแนกไลเคนบางกลุ่ม เช่น *Lecanora* sp. ส่วน pruina<br>ส่วนใหญ่ประกอบด้วยผลึกของแคลเซียมออกซาเลทละเอียดถึงหยาบ |
| **Culture medium**, อาหารเลี้ยงเชื้อ | อาหารที่ใช้เลี้ยงจุลินทรีย์ |
| **Cuneate**[50], ***รูปลิ่ม*** | รูปลิ่ม เช่น ปลายโลปที่มีลักษณะคล้ายรูปลิ่ม |
| **Cupulate**[51], คล้ายถ้วย | รูปถ้วย |
| **Cups**, ถ้วย | บริเวณปลายโพดิเทีย (podetia) ของไลเคนในสกุล *Cladonia* ที่มีลักษณะคล้ายถ้วย เป็นที่กำเนิดของแอโพทีเชียและพิคนิเดีย |
| **Cyanobacteria** | สาหร่ายสีเขียวแกมน้ำเงิน (Blue-green algae) |
| **Cylindrical, *-รูปทรงกระบอก*** | รูปทรงกระบอก |
| **Cyphellae**[52], ไซฟีลเล<br>(sing. cyphella - ไซฟีลลา) | โครงสร้างลักษณะคล้ายหลุมเล็ก ๆ มีขอบ ค่อนข้างกลม อยู่ด้านล่างแทลลัสทำหน้าที่ในการแลกเปลี่ยนแก๊ส (ต่างจาก pseudocyphellae)<br>มีไลเคนเพียงสกุลเดียวที่มีไซฟิลเลคือ สกุล *Sticta* |

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| Dactyl[53], แดกทิล | ไอซิเดียที่บริเวณตรงปลายหัก เผยให้เห็นชั้นเมดัลลา |
| Decryoid[54], คล้ายหยดน้ำ | คล้ายหยดน้ำ |
| Dentate[55], ***หยักซี่ฟัน*** | ฟันเลื่อยหยาบ |
| Denticulate[56], ***หยักซี่ฟันถี่*** | ฟันเลื่อยละเอียด |
| Depsidone | กลุ่มของสารทุติยภูมิที่พบในไลเคน |
| Diaspore, ส่วนแพร่พันธุ์ | ส่วนที่ใช้แพร่พันธุ์ รวมทั้งแบบอาศัยเพศและแบบไม่อาศัยเพศ |
| Dichotomous[57], ***แยกสองแฉก*** | ลักษณะการแตกแขนงจากแกนเดิมเป็นสองแฉก |
| Diffuse, แผ่กระจาย | เช่น การกระจายของซอราเลีย อย่างสม่ำเสมอทั่วแทลลัส |
| Dimidiate[58], (of perithecia) | รูปแบบของชั้นเอกซิเปิลที่ไม่สมบูรณ์ โดยมีฐานด้านล่างเปิด |
| Dimorphic, ***ทวิสัณฐาน*** | ประกอบด้วยรูปร่าง/โครงสร้าง 2 แบบ |
| Disc (apothecia) [59], ***จานฐาน, ดอกจาน*** | ส่วนบนของแอสโคมาที่สร้างแอสโคสปอร์ อาจเรียบกลม หรือโค้งนูน |
| Discocarp, ดิสโคคาร์ป | โครงสร้างสืบพันธุ์รูปจาน |
| Discocarpic, ดิสโคคาร์ปิค (of mycobionts) | ราที่สร้างแอโพทีเซียรูปจาน |
| Discoid[60], ***คล้ายจาน*** | รูปคล้ายจาน |
| Distoseptate[61], ดิสโทเซพเตท | มีผนังกั้นที่หนาและเห็นชัดเจน |
| Disporic, (or bisporic) | ภายในหนึ่งถุงหุ้มสปอร์ (ascus) ผลิต 2 แอสโคสปอร์ |
| Dissected, - ***ตัดแยก*** | ตัดแยก |
| Divaricate, - ***ถ่าง, ถ่างมาก*** | ถ่างมาก |
| Dorsiventral, ***มีด้านบนด้านล่างต่างกัน*** | ผิวด้านบนและด้านล่าง |
| E- (อักษรนำหน้าทั่วไป) | ปราศจาก ไม่มี เช่น ecorticate- ไม่มีคอร์เทกซ์ epruinose- ไม่มี pruinose |
| Eciliate | ไม่มีขนเซลล์ |
| Ecorticate, ไม่มีคอร์เทกซ์ | ไม่มีการสร้างชั้นคอร์เทกซ์ |
| Effigurate (of crustose) | มีขอบเขตแทลลัสที่ชัดเจน |
| Ellipsoid[62], ***ทรงรี*** | รูปทรงไข่ และทรงรี |
| Elongate[63], ***ยืด*** | ยาวเรียว |
| Endemic, - ***ถิ่นเดียว, ประจำถิ่น*** | พบเฉพาะแห่ง ไม่พบในที่อื่น |

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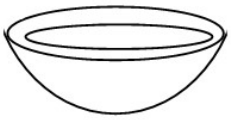
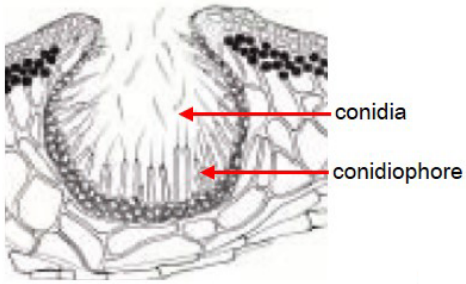
| **Endo-** (คำนำหน้าทั่วไป): | อยู่ภายในสิ่งใด ๆ |
| **Endolithic** (of thallus) | ฝังจมในหินอย่างสมบูรณ์ รวมทั้งชั้นสาหร่าย โดยทั่วไปมีอย่างน้อยสองแบบ คือ แบบที่ฝังอยู่ในหินปูนและแบบที่ฝังในหินซิลิเกต ในที่แห้งแล้งมาก เช่น ทะเลทรายหรือที่ว่างเปล่าในแอนตาร์กติกา |
| **Endosubstratic** (of thallus) | ฝังตัวอยู่ในพื้นที่อยู่อาศัยอย่างสมบูรณ์ รวมทั้งชั้นสาหร่าย |
| **Epi-** (คำนำหน้าทั่วไป) | อยู่บน อยู่เหนือสิ่งใด ๆ |
| **Epicortex**, ชั้นเหนือคอร์เทกซ์ | ชั้นของเนื้อเยื่อบางเป็นพวกพอลิแซ็กคาไรด์ คลุมชั้นคอร์เทกซ์ |
| **Epihymenium** (of apothecia) | ชั้นเหนือไฮเมเนียม (ดู epithecium) |
| **Epilithic** (of thallus), ***ขึ้นบนหิน*** | ขึ้นบนผิวหน้าหิน (ดู endolithic) |
| **Epinecral layer** (thallus surface) | ชั้นที่อยู่เหนือชั้นผิวบน (upper cortex) ของแทลลัส ที่เกิดจากการตายของเซลล์รา พบในไลเคนครัสโตสหลายชนิด |
| **Epipsamma** | ชั้นอิพิไฮเมเนียม (epihymenium) ที่สะสมผลึกไว้จำนวนมาก |
| **Epiphyte**, ***พืชอิงอาศัย*** | พืชที่เกาะพืชชนิดอื่นอยู่ แต่ไม่ได้ดูดอาหารจากพืชชนิดนั้น เช่น ไลเคน มอสส์ กล้วยไม้ และเฟิร์น |
| **Epispore** | ส่วนที่อยู่ด้านนอกของผนังสปอร์ เมื่อหนาขึ้นอาจกลายเป็นเมือก/วุ้น (gelatinous) หรือมีรูปร่างต่าง ๆ เช่น เป็นสันหรือปุ่ม |
| **Epithecium**[64], อิพิทีเซียม | ชั้นบนสุดของไฮเมเนียม เกิดจากบริเวณปลายเส้นใยพาราไฟซิสที่มีสีเข้ม บางครั้งสามารถใช้ลักษณะของโครงสร้างนี้จำแนกชนิดไลเคนได้ |
| **Epruinose**, ไม่มีนวล | ไม่มีนวลปกคลุม |
| **Erumpent**[65] (crater-like), คล้ายแอ่ง | กึ่งฝังในแทลลัสรูปคล้ายปล่องภูเขาไฟ |
| **Eso-** (คำนำหน้าทั่วไป) | อยู่ภายนอกสิ่งใด ๆ |
| **Esoascus** (of asci) | ดู bitunicate |
| **Exciple**[66], เอกซิเปิล (of ascocarp) | เนื้อเยื่อที่เป็นขอบของแอโพทีเซียหรือผนังของเพอริทีเซีย |
| **Excipulum** | ดู exciple |
| **Exfoliate**, ***ลอก*** | ลอก |
| **Exospore**, เอกโซสปอร์ | ผนังชั้นนอกของสปอร์ |
| **Fabiform**, - รูปถั่ว | คล้ายถั่ว |
| **Facicle**, - เป็นฟ่อน, - เป็นมัด | กระจุก |
| **Falcate**[67], - ***รูปเคียว*** | รูปร่างคล้ายเคียว |
| **Farinose**, ***มีนวลแป้ง*** | มีนวลแป้ง |



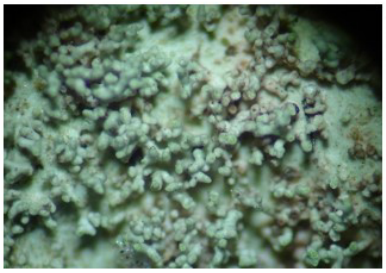
41. concave

42. conical

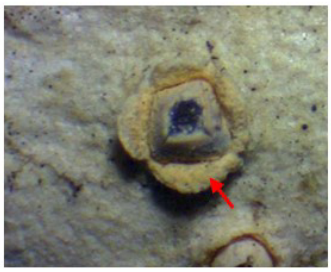
44. convex



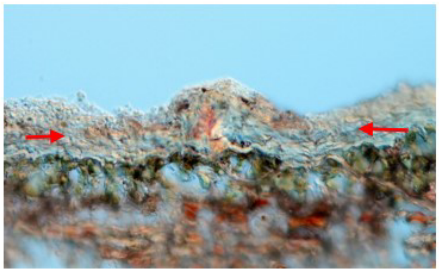

43. conidia and conidiophore



45. coralloid

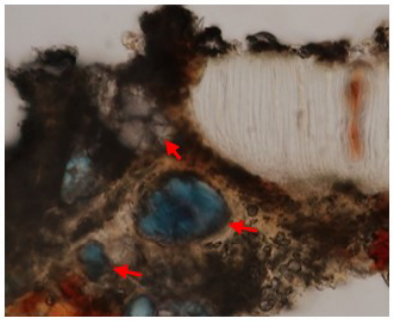


46. corona

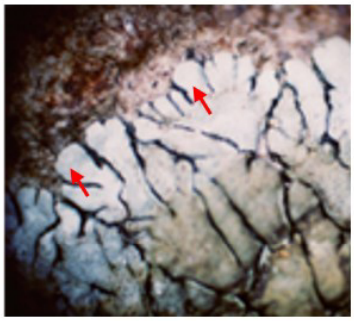


47. cortex

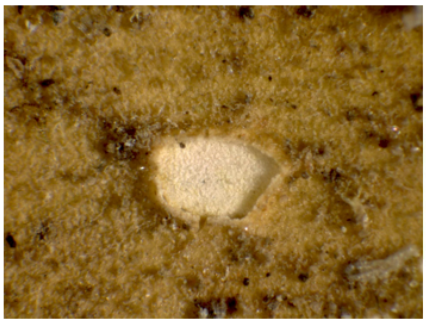
48. crustose



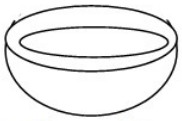
49. crystal



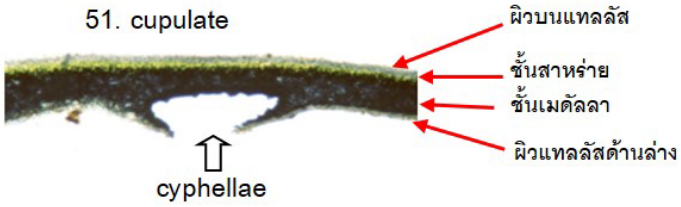
50. cuneate



52. cyphellae



51. cupulate




52. cyphellae

53. dactyl

54. decryoid

55. dentate

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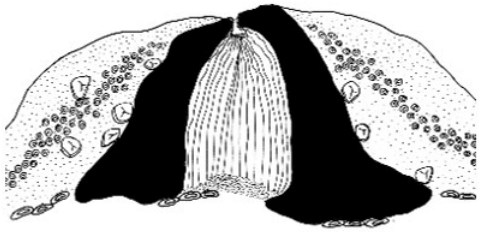
| Fasciculate | การแตกออกจากตำแหน่งเดียวกันและมักจะขนานกัน เช่น การแตกของไรซีน (Rhizine) |
| Fibril[68], ***เส้นใยฝอย*** | เส้นใยฝอย หรือแขนงสั้น ๆ ที่แตกออกจากด้านข้างของแทลลัส แบบฟรูทิโคส พบมากในสกุล *Usnea* |
| Filamentous[69], ***คล้ายเส้นด้าย*** | การเรียงตัวของเส้นใยราที่มีลักษณะโครงสร้างเป็นเส้นสาย |
| Filiform[70], - ***รูปเส้นด้าย*** | รูปเส้นด้าย/รูปเข็ม |
| Fissitunicate (of asci) | การปล่อยสปอร์ของถุงหุ้มสปอร์ที่มีผนัง 2 ชั้น โดยชั้นนอกแตกออก ชั้นในยื่นยาวและปล่อยสปอร์โดยใช้แรงดัน |
| Flabellate[71], - ***รูปพัด*** | รูปพัด |
| Flexuous, - ***คดไปมา*** | ลักษณะโค้งงอ และบิดไปมามากกว่า 1 ครั้ง ของแอโพทีเซียแบบยาวเรียว |
| Foliicolous[72] | ไลเคนบนใบไม้ |
| Foliose[73], โฟลิโอส | ไลเคนที่มีการเจริญของแทลลัส ลักษณะเป็นแผ่นคล้ายใบไม้ เกาะอาศัยโดยใช้เส้นใยของราหรือเส้นใยของราเปลี่ยนรูปแบบไปเป็นไรซีน |
| Foveolate (of thalli), - ***มีรอยบุ๋ม*** | แทลลัสที่มีรอยบุ๋ม |
| Fruticose[74], ฟรูทิโคส/เส้นสาย | ไลเคนที่มีการเจริญของแทลลัส แบบเส้นสาย/ลักษณะของไลเคนแบบที่เป็นเส้นสาย ฟุ่ม โดยมีทุกส่วนสัมผัสอากาศ |
| Fusiform[75], - ***รูปกระสวย*** | รูปกระสวย ลักษณะเรียวแหลมทั้งหัวและท้าย |
| Gelatinous lichen[76] | ไลเคนที่มีลักษณะคล้ายเห็ดหูหนูมีทั้งสีน้ำตาลแก่ถึงสีดำ พบสาหร่ายสีเขียวแกมน้ำเงิน (Cyanobacteria, Blue-green algae) เป็นส่วนประกอบ |
| Globose[77], -***ทรงกลม*** | ทรงกลม |
| Glabrous | ไม่มี hair หรือ tomentum (ดู hair และ tomentum) |
| *Gloeocapsa* | สกุลหนึ่งของสาหร่ายสีเขียวแกมน้ำเงิน |
| Goniocyst | กลุ่มของสาหร่ายที่ถูกล้อมรอบด้วยเส้นใยราสั้น ๆ ลักษณะเป็นก้อนกลม ขนาดเล็กบนผิวของแทลลัส |
| Granular[78], ***เป็นตุ่มเล็ก, เป็นเม็ดละเอียด*** | กลุ่มของเม็ดกลมละเอียด เป็นเม็ด |
| Granule, เม็ดเล็ก ๆ | เป็นตุ่มเล็ก |
| Granulose (of soralia) | เป็นตุ่มเล็ก เป็นละออง เป็นเม็ดละเอียด |
| Green algae, สาหร่ายสีเขียว | สาหร่ายสีเขียว |
| Habitat, ***ถิ่นที่อยู่*** | ที่อยู่อาศัย |
| Hairs | เส้นใยราลักษณะสั้น ตั้งตรง คล้ายเส้นผม เกิดอยู่บนผิวบนแทลลัส |

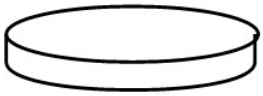
56. denticulate

57. dichotomous

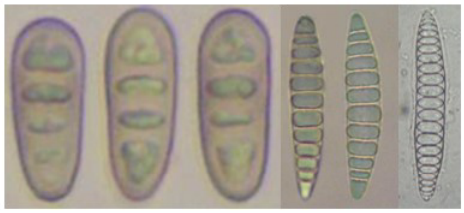


58. dimidiate

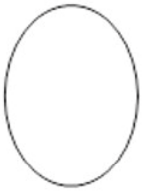
59. disc



60. discoid

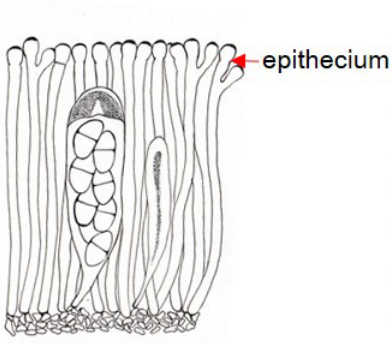


61. distoseptate

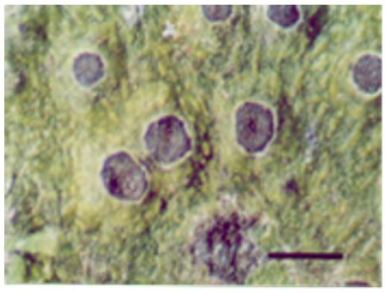


62. ellipsoid

63. elongate




64. epithecium



65. erumpent

66. exciple

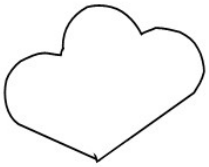
67. falcate

68. fibril

69. filamentous

70. filiform

| | |
|---|---|
| **Halonate**[79] (of spores) | เยื่อลักษณะใส คล้ายวุ้นห่อหุ้มสปอร์ |
| **Hamathecium** (of ascocarps) | เนื้อเยื่อที่ประกอบไปด้วยเส้นใยราที่เป็นหมันที่อยู่ในไฮเมเนียม ได้แก่ พาราไฟซิส (paraphyses) พาราไฟซอยด์ (paraphysoids) และ เพอริไฟซิส (periphyses) เป็นต้น |
| **Haustorium** | เส้นใยของราที่แทรกเข้าไปอยู่ในเซลล์ของสาหร่าย |
| **Hemispherical**[80] | รูปครึ่งวงกลม |
| **Hemiangiocarp** (of ascocarps) | ชั้นไฮเมเนียมเริ่มแรกปกคลุมด้วยเนื้อเยื่อ แต่จะเปิดออกเมื่อถุงหุ้มสปอร์แก่ |
| **Hemiendosubstratic** (of thalli) | แทลลัสฝังจมในที่เกาะอาศัย ยกเว้นชั้นสาหร่าย |
| **Heteromerous**, เฮเทอโรเมอรัส | แทลลัสที่มีลักษณะการเรียงตัวของราและสาหร่ายแบ่งเป็นชั้นอย่างชัดเจน |
| **Heterocyst** (of photobionts) | เซลล์ที่มีสีจางและผนังหนาของสาหร่ายสีเขียวแกมน้ำเงิน ทำหน้าที่ตรึงไนโตรเจน |
| **Holdfast**[81], ***ส่วนยึด*** | ส่วนล่างของแทลลัสที่พัฒนาไปใช้ในการยึดเกาะกับพื้นที่อยู่อาศัย (substrate) ที่จุดเดียว |
| **Homoiomerous**[82], ฮอโมอิโอเมอรัส | แทลลัสที่มีลักษณะการเรียงตัวของราและสาหร่ายอย่างไม่เป็นระเบียบ ทำให้ไม่เกิดเป็นชั้นที่ชัดเจน |
| **Hollow**[83] | แกนกลางกลวง |
| **Hyaline**, ***ใส*** | ใส ไม่มีสี เช่น สปอร์ที่ไม่มีสีหรือใส |
| **Hymenium**[84], ไฮเมเนียม | โครงสร้างภายในแอสโคมา เป็นชั้นที่ให้กำเนิดแอสโคสปอร์ ประกอบด้วย เส้นพาราไฟซิส แอสคัส และแอสโคสปอร์ |
| **Hypophore**[85], ไฮโพฟอร์ | โครงสร้างสืบพันธุ์แบบไม่อาศัยเพศ ลักษณะคล้ายเส้นขน |
| **Hypothallus**[86], ไฮโพแทลลัส | ส่วนของเส้นใยราที่มีการเจริญเร็วกว่าแทลลัส มีสีเทาหรือสีดำและไม่มีสาหร่ายเจริญอยู่ด้วย |
| **Hypothecium**[87], ไฮโพทีเซียม | เป็นฐานของชั้นไฮเมเนียม |
| **Imbricated**, ***ซ้อนเหลื่อม*** | ซ้อนกัน/เหลื่อมกัน |
| **Immersed**[88] (of ascocarps and pycnidia) | ฝังตัวในที่เกาะอาศัยหรือในแทลลัส เช่น การฝังตัวของแอสโคคาร์ปในเนื้อเยื่อสโตรมา |
| **Implicate**, - ขอบพับ | ขอบพับ |
| **Incised**, จักลึก | จักลึก/หยักลึก |
| **Inflated**, ***พอง*** | พอง |
| **Infundibuliform**[89], - ***รูปกรวย***, - ***รูปแตร***, - ***รูปลำโพง*** | รูปกรวย |
| **Inspersed**[90] (of the hymenium, in section) | ชั้นไฮเมเนียมที่มีหยดน้ำมันแผ่กระจาย ทำให้มีความขุ่นเมื่อส่องภายใต้กล้องจุลทรรศน์ |
| **Involucrellum**[91], อินโวลูเครลลัม | ส่วนที่คลุมเพอริทีเซีย เป็นเส้นใยราที่เป็นหมันรวมตัวกันเป็นเนื้อเยื่อ ส่วนใหญ่มีสีดำ ช่วยป้องกันเพอริทีเซีย อยู่ระหว่างผิวชั้นนอกกับชั้นเอกซิเปิล |



71. flabellate

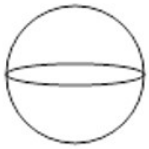
72. foliicolous

73. foliose

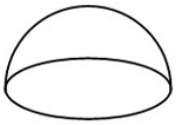
75. fusiform

74. fruticose

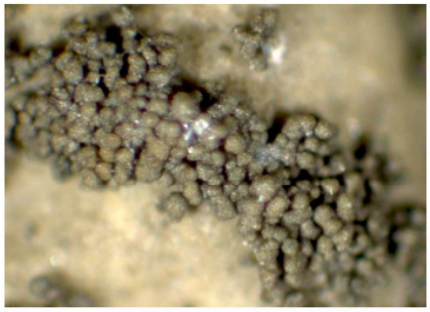
76. gelatinous lichen



77. globose

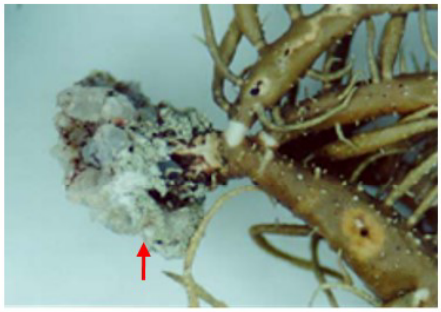


80. hemispherical

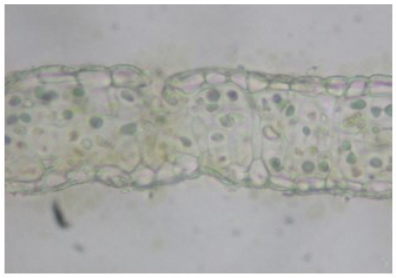


78. granular

79. halonate

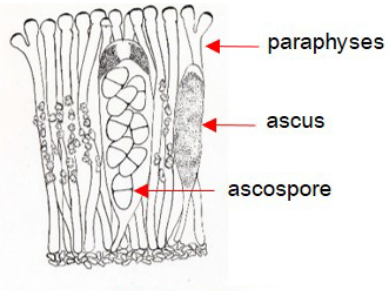


81. holdfast



82. homoiomerous

83. hollow




84. hymenium

85. hypophore

86. hypothallus

87. hypothecium

| | |
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| Isidia[92], ไอซิเดีย | เป็นส่วนหนึ่งของแทลลัสที่ยื่นออกไปในอากาศ ลักษณะคล้ายเข็มสั้น ๆ แท่ง ตุ่มกลม หรือคล้ายปะการัง |
| Labia[93], - รูปปาก | ส่วนบนของชั้นเอกซิเปิล อาจเป็นแบบเรียบหรือแยกเป็นริ้ว |
| Labriform[94], - คล้ายรูปปาก | คล้ายริมฝีปาก |
| Laciniate, - ***จักเป็นครุย*** | แบ่งออกเป็นโลปที่ปลายมีขนาดเล็กเรียวแหลม |
| Lageniform, - ***รูปน้ำเต้า*** | รูปน้ำเต้า |
| Laminal | อยู่บนผิวด้านบนของแทลลัส |
| Lax | โปร่ง หรือเส้นใยราสานตัวกันอย่างหลวม ๆ |
| Lecanorine apothecia[95], เลคาโนรีน แอโพทีเชีย | ลักษณะของขอบแอโพทีเชียสีเดียวกับแทลลัส และมีสาหร่ายเป็นองค์ประกอบ |
| Lecideine apothecia[96], เลซิเดอีน แอโพทีเชีย | ลักษณะขอบของแอโพทีเชียที่ขอบมีสีแตกต่างจากแทลลัส อาจมีสีเดียวกับผิวหน้าจาน และไม่มีสาหร่ายเป็นองค์ประกอบ |
| Lens[97] | รูปเลนส์ |
| Lenticular | รูปเลนส์ |
| Lepadinoid, เลพาดินอยด์ | แอโพทีเชียที่ฝังจมหรือกึ่งฝังจมในแทลลัส ขอบยกตัวและอาจแยกออกจากกัน |
| Leprose[98], ลีโพรส | ลักษณะคล้ายฝุ่นผงกระจายตัวหลวม ๆ ไม่แน่น |
| Lichen substance, สารไลเคน | สารธรรมชาติที่ไลเคนผลิตขึ้นมา |
| Lichenan, ไลคีแนน | สารประกอบพวกพอลิแซ็กคาไรด์ของราที่เป็นส่วนประกอบของไลเคน ส่วนใหญ่พบใน Parmeliaceae |
| Lichenicolous lichen, ไลเคนบนไลเคน | ไลเคนที่เติบโตบนหรือในแทลลัสของไลเคนอีกชนิดหนึ่ง |
| Lichenised (of mycobionts) | ราที่เจริญอยู่ร่วมกับสาหร่ายในภาวะพึ่งพิงซึ่งกันและกัน |
| Lichenometry, มาตรไลเคน | การใช้ไลเคนตรวจวัดอายุวัตถุ เช่น หิน หรือโบราณสถาน |
| Lichexanthone, ไลคีแซนโทน | กลุ่มสารอินทรีย์ทุติยภูมิที่ไลเคนสร้างขึ้น |
| Linear, - เรียวขนาน | เรียวขนาน |
| Lingulate, - ***รูปลิ้น*** | รูปลิ้น |
| Lirellate apothecia[99], แอโพทีเชียแบบเส้นคู่ | ลักษณะของแอโพทีเชียรูปร่างยาวเรียว ประกอบด้วย 2 แนวมาประกบกันคล้ายริมฝีปาก พบใน Graphidaceae |
| Lirelliform (of apothecia) | แอโพทีเชียที่มีรูปร่างยาว เรียว |

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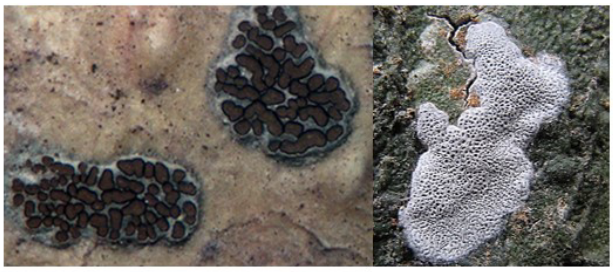
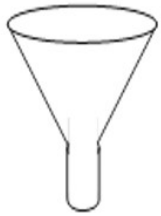
|---|---|
| Lobes[100], **โลป** | บริเวณขอบของแทลลัสที่มีลักษณะแบนและยื่นยาว |
| Lobulate, - แบ่งเป็นกลีบย่อย | โลปขนาดเล็ก ดูเสมือนปลายเป็นฝอย |
| Lobule, ***แฉกเล็ก, พูเล็ก, หยักเล็ก*** | โลปขนาดเล็ก ที่เจริญจากโลปเดิมหรือเกิดการเปลี่ยนแปลง มาจากไอซิเดีย และเจริญเป็นโลปขนาดใหญ่ต่อไป |
| Locule, ***ช่อง*** | แอสโคคาร์ปหลายอันที่อยู่ในเนื้อเยื่อสโตรมามองเห็นเป็นหลายช่องหรือหลายห้อง |
| Macrocephalic[101], - หัวโต | สปอร์ที่มีผนังตามขวาง โดยเซลล์ปลายด้านหนึ่งใหญ่กว่าอีกด้าน |
| Macrolichen[102], มหไลเคน | ไลเคนขนาดใหญ่ เช่น โฟลิโอส ฟรูทิโคส และสแควมูโลสไลเคน |
| Macroconidia | โคนิเดียที่มีขนาดใหญ่กว่า microconidia พบได้ในไลเคนที่สร้างโคนิเดีย มากกว่า 1 ชนิด (ดู microconidia) |
| Maculiform (of soralia) | รูปร่างของกลุ่มซอราเลียมีลักษณะกลม ขนาดเล็ก มักพบบริเวณกลางแทลลัส |
| Marginal[103] (of soralia) | ซอราเลียที่พบเฉพาะที่ขอบแทลลัสหรือปลายโลป |
| Margin (of apothecia) | ขอบแอโพทีเซีย แบ่งออกเป็น 2 แบบคือ proper margin และ thalline margin |
| Mazaedium[104], มาซีเดียม | มวลสปอร์ (spores mass) ที่อยู่รวมกันเป็นกลุ่ม (ไม่ได้อยู่ในถุงหุ้มสปอร์) พบบนแอสโคมา |
| Medulla, ***เมดัลลา*** | ส่วนหนึ่งของโครงสร้าง (thallus) ของไลเคน ประกอบด้วยเส้นใยรา (mycelium) ที่สานตัวกัน ทำหน้าที่สะสมสารอินทรีย์ทุติยภูมิ และดูดซับน้ำ |
| Membranous, ***เป็นเยื่อ*** | เป็นเยื่อ |
| Metabolism, ***เมแทบอลิซึม*** | กระบวนการทางชีวเคมีของสิ่งมีชีวิตที่มีการสร้างและใช้ (สลาย) สารอินทรีย์ |
| Micareoid (of photobionts) | สาหร่ายสีเขียวที่มีเส้นผ่านศูนย์กลางระหว่าง 4-7 ไมโครเมตร ผนังบาง และพบเซลล์เจริญอยู่เป็นคู่ |
| Microclimate, ภูมิอากาศจุลภาค | ภูมิอากาศในบริเวณเล็ก ๆ ซึ่งแตกต่างจากภูมิอากาศโดยรอบ เช่น บริเวณซอกหิน หรือใต้ร่มเงาพืชยืนต้นขนาดใหญ่ที่มีเรือนยอดแผ่กว้าง โดยมีสิ่งมีชีวิตบางพวกที่อาศัยอยู่จำเพาะบริเวณเหล่านี้ |
| Microconidia (sing. microconidium) | โคนิเดียที่มีขนาดเล็ก พบได้ในไลเคนบางชนิดที่สร้างโคนิเดียมากกว่า 1 ชนิด คือขนาดเล็ก และขนาดใหญ่ (ดู macroconidia) |
| Microlichen[105], จุลไลเคน | ไลเคนขนาดเล็ก เช่น ครัสโตสไลเคน |
| Moniliform[106], - ***รูปคล้ายสายลูกปัด*** | เรียงกันเป็นเส้นคล้ายสร้อยลูกปัด |
| Multiseptate, หลายผนังกั้น | ผนังกั้นตามขวางหลายผนัง |
| Muriform[107], ***ขีดมีลาย, มูริฟอร์ม*** | แอสโคสปอร์ที่เซลล์มีผนังตามขวาง และตามยาว |

| | |
|---|---|
| Mycelium, ***กลุ่มใยรา*** | เส้นใยรา (hyphae) ที่รวมกันเป็นกลุ่ม |
| Mycobiont, ***ราสหชีพ***, **มายคอไบออนท์** | ราที่เป็นคู่ของสาหร่ายในไลเคน |
| Oblong[108], - ***รูปขอบขนาน*** | รูปขอบขนาน/ทรงกระบอกปลายมน |
| Obovate, - ***รูปไข่กลับหัว*** | รูปไข่ด้านเรียวอยู่ข้างล่าง |
| Obovoid, - คล้ายรูปไข่กลับ | รูปร่างคล้ายรูปไข่ด้านเรียวอยู่ข้างล่าง |
| Obtuse[109], - ***ป้าน***, - ***มน*** | ปลายป้าน/ปลายมน |
| Ocular chamber (of asci) | ผนังชั้นในของแอสคัสที่มีลักษณะคล้ายโดมยื่นเข้าไปในส่วน tholus (ดู apical dome) |
| Ornamented (of spores) | ผนังของสปอร์ที่มีลวดลาย ผิวไม่เรียบ |
| Orbicular[110], - ***รูปวงกลม*** | รูปวงกลม/เส้นขอบเป็นวงกลม |
| Orchil[111], ออร์ชิล | ชื่อของสีชนิดหนึ่งที่สกัดได้จากไลเคนโดยการหมักด้วยแอมโมเนีย ให้โทนสีม่วง |
| Ostiole[112], - ***ช่องเปิด*** | รูหรือช่องขนาดเล็ก สำหรับปล่อยแอสโคสปอร์ พบในไลเคนกลุ่มที่สร้างโครงสร้างสืบพันธุ์แบบเพอริทีเซีย เช่น กลุ่ม pyrenolichen |
| Ovate, - ***รูปไข่*** | รูปไข่ด้านเรียวอยู่ข้างบน |
| *P* (para-phenylenediamine, reagents) | สารที่ใช้ทดสอบสารอินทรีย์ทุติยภูมิในไลเคนด้วยวิธีการหยดสี (spot tests) |
| Palisade, ***แพลิเซด*** | เส้นใยราที่เรียงตัวในแนวตั้งฉากกับพื้นผิว |
| Papilla (pl. papillae), ***ปุ่มเนื้อ*** | ปุ่มเล็ก |
| Paraphyses[113], ***เส้นแทรก***, พาราไฟซิส | เส้นใยราที่เป็นหมัน เช่น ในแอโพทีเซีย บริเวณชั้นไฮเมเนียมมีทั้งแบบเส้นเดี่ยวหรือแบบแตกแขนง |
| Paraphysoid[114], พาราไฟซอยด์ | เส้นใยราที่เป็นหมัน พัฒนาจากส่วนบนของเพอริทีเซีย ลงมาจนถึงฐานของเพอริทีเซีย |
| Paraplectenchyma[115], พาราเพลคเทนคายมา | ลักษณะของเนื้อเยื่อ และเซลล์ค่อนข้างกลมคล้าย parenchyma ของพืชชั้นสูง เรียงตัวในแนวตั้งฉากกับแทลลัส |
| Parasite | สิ่งมีชีวิตที่เจริญและได้รับอาหารจากสิ่งมีชีวิตอื่น (เจ้าบ้าน) ต่อมาทำให้เจ้าบ้านเติบโตลดลงหรือตาย |
| Parasymbiont, พาราซิมไบออนท์ | สิ่งมีชีวิตที่อยู่ร่วมกันแบบพึ่งพาอาศัย มีเนื้อเยื่อเชื่อมกันโดยไม่มีการสร้างสารยับยั้งหรือต่อต้านการเติบโตกัน |
| Parathecium, พาราทีเซียม | เยื่อหุ้มด้านนอกของแอโพทีเซีย ส่วนใหญ่สีดำ |
| Peltate | ลักษณะคล้ายโล่ |



88. immersed



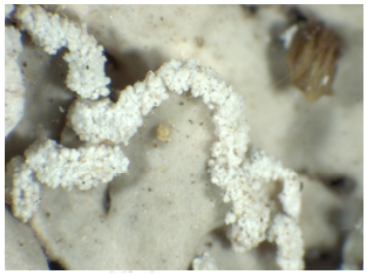
89. infundibuliform

90. inspersed

91. involucrellum

92. isidia

93. labia



94. labriform

95. lecanorine apothecia

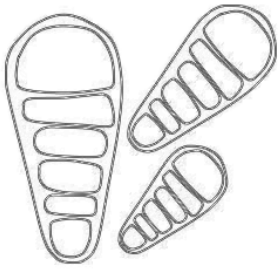
96. lecideine apothecia

97. lens

98. leprose

100. lobes

99. lirellate apothecia



101. macrocephalic

| | |
|---|---|
| **Pendulous**, - ห้อย | แทลลัสที่ห้อยเป็นเส้น (สกุล *Usnea*) |
| **Perforate**, - ถูกแทงทะลุ , - เป็นรู | รูพรุน |
| **Periclinal**, ***ขนานกับผิว*** | ขนานกับผิว |
| **Peripheral**, -ขอบ, - ส่วนขอบ, -รอบนอก, - ส่วนปลาย | บริเวณรอบนอก |
| **Periphyses**[116], เพอริไฟซิส | เส้นใยราที่เป็นหมัน เจริญอยู่ด้านในของช่องเปิด (ostiole) โดยเส้นใยชี้ขึ้น |
| **Periphysoid**[117], เพอริไฟซอยด์ | เส้นใยราที่เป็นหมัน เจริญอยู่ด้านในของช่องเปิด (ostiole) โดยเส้นใยชี้ลง |
| **Perispore** (of spores) | ผนังชั้นนอกที่ล้อมรอบสปอร์ |
| **Perithecium**[118] (pl. perithecia), เพอริทีเซียม | โครงสร้างที่ใช้ในการขยายพันธุ์แบบอาศัยเพศมีลักษณะภายนอกคล้ายเม็ดตุ่มขนาดเล็ก ภายในเป็นรูปคนโท (flask shape) |
| **Perithecioid** | เหมือนเพอริทีเซีย |
| **Photobiont**, โฟโตไบออนท์/สาหร่ายสหชีพ | สาหร่ายที่อยู่ร่วมกับราในไลเคน อาจเป็นสาหร่ายสีเขียวหรือสาหร่ายสีเขียวแกมน้ำเงิน (Cyanobacteria, Blue-green algae) ไลเคนบางชนิดอาจมีสาหร่ายทั้งสองกลุ่ม |
| **Phycobiont**[119], ***สาหร่ายสหชีพ*** | สาหร่ายสีเขียวที่อยู่ร่วมกับราในไลเคน |
| **Phyllidia**[120], ฟิลลิเดีย | รยางค์รูปร่างเป็นเกล็ดคล้ายโลปขนาดเล็กที่ยืดยาวออกจากแทลลัสของไลเคน |
| **Phyllocladia** | โครงสร้างคล้ายใบเกล็ดขนาดเล็กและมีสาหร่ายเป็นองค์ประกอบยื่นออกมาจากแทลลัสของไลเคนสกุล *Stereocaulon* |
| **Pigment**, ***สารสี, รงควัตถุ*** | รงควัตถุหรือสารสีในพืชหรือไลเคน |
| **Placodiomorph** (of crustose) | ลักษณะแทลลัสครัสโตสที่มีขอบโลปแผ่เป็นรัศมี |
| **Placoid**[121], พลาคอยด์ | แทลลัสเป็นโลปเรียวเล็กอยู่ติดกับที่อยู่อาศัยแน่น |
| **Plantation**, ที่ดินเป็นที่เพาะปลูก | พื้นที่เพาะปลูก |
| **Plectenchyma**, เพลคเทนคายมา | ดู prosoplectenchyma |
| **Plicate**[122], - ***พับจีบ*** | พับจีบ |
| **Pluricellular** (of spores) | สปอร์ที่มีเซลล์จำนวนมาก |
| **Podetium**[123] (pl. podetia), โพดิเทียม (โพดิเทีย) | ส่วนของแทลลัสที่ตั้งตรงยื่นออกไปในอากาศของ สกุล *Cladonia* ตรงปลายอาจมีการสร้างแอโพทีเซีย |
| **Polarilocular**[124], โพลาริโลคูลาร์ | สปอร์ที่มีสองเซลล์แยกกันด้วยผนังหนาที่มีร่องตรงกลาง |
| **Polar-diblastic** (of spores) | สปอร์ 2 เซลล์ ที่เซลล์เชื่อมต่อกันด้วยช่องแคบ ๆ |
| **Polymorphic** | มีรูปร่างหลายแบบ |

102. macrolichen

103. marginal (of soralia)

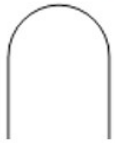
104. mazaedium

105. microlichen

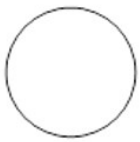
106. moniliform

107. muriform

108. oblong

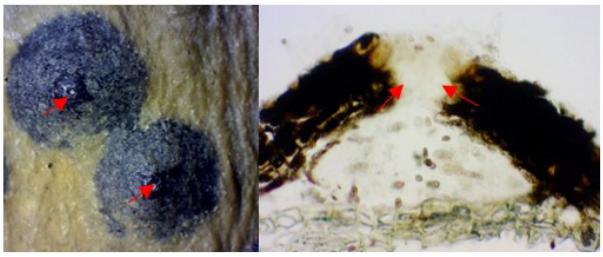


109. obtuse

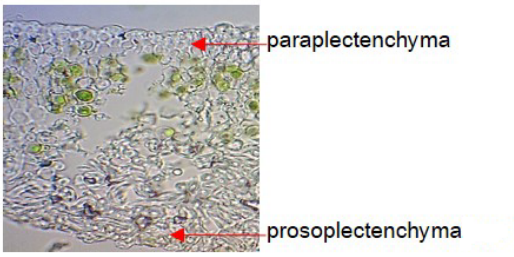


110. orbicular

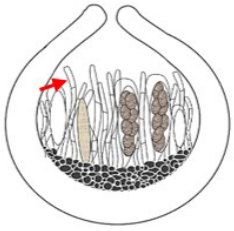

111. orchil



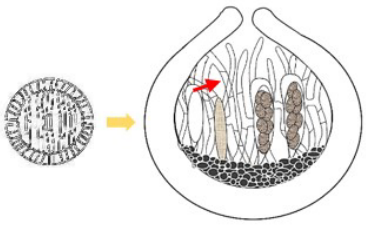
112. ostiole



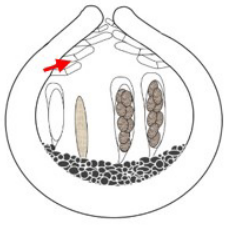

115. paraplectenchyma



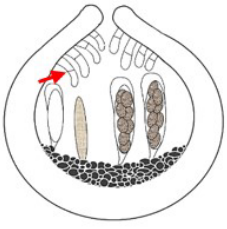
113. paraphyses



114. paraphysoid



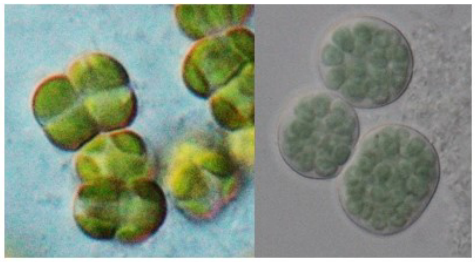
116. periphyses



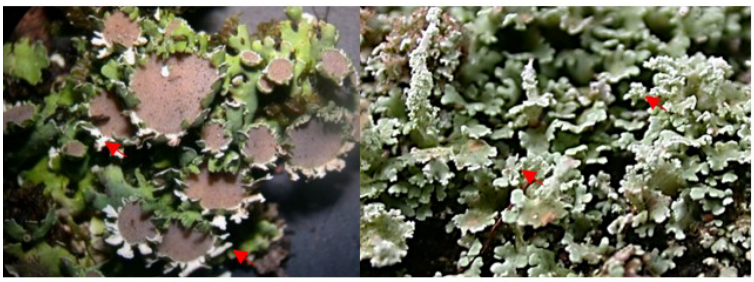
117. periphysoid

| | |
|---|---|
| **Primary thallus**[125] | แทลลัสครัสโตสหรือสแควมูโลส ทำหน้าที่สร้าง podetia หรือ pseudopodetia ในไลเคนสกุล *Cladonia* |
| **Propagule** | โครงสร้างกระจายพันธุ์ของไลเคนแบบไม่อาศัยเพศ เช่น ซอรีเดีย หรือไอซิเดีย เป็นต้น |
| **Proper exciple**[126] | เอกซิเปิลไม่มีสาหร่าย |
| **Proper margin** | ขอบแอโพทีเซียที่มีสีแตกต่างจากแทลลัสภายในไม่มีสาหร่าย |
| **Prosoplectenchyma,** โพรโสเพลคเทนคายมา | ลักษณะของเนื้อเยื่อและเซลล์ค่อนข้างเรียวยาวเรียงตัวในแนวขนานกับแทลลัส |
| **Prothallus**[127] | ขอบแทลลัสในครัสโตสไลเคนที่มีเพียงส่วนของราทำให้มีลักษณะและสีแตกต่างจากแทลลัสในส่วนอื่น |
| **Pruina**[128], นวล | ผลึกหรือฝุ่นผงที่ปกคลุมอยู่ที่ผิวด้านบนของแทลลัสหรือแอโพทีเซีย เกิดจากการขับสารแคลเซียมออกซาเลต (calcium oxalate) ออกมาจากแทลลัส |
| **Pruinose, - *มีนวล*** | นวล/ลักษณะคล้ายฝุ่นแป้งสีนวลเคลือบผิวหน้าแทลลัส |
| **Pseudocyphellae**[129], ซูโดไซฟีลเล | ลักษณะเป็นหลุมเล็ก ๆ ไม่มีขอบ เกิดขึ้นที่ผิวบนและผิวล่างของแทลลัส |
| **Pseudoparaphysis,** ซูโดพาราไฟซิส | เส้นใยราที่เป็นหมันเจริญจากด้านบนลงด้านล่างภายในช่องว่าง (centrum) ของ ascostroma |
| **Pseudoparenchyma,** ซูโดพาเรนคายมา | ดู paraplectenchyma |
| **Pseudoseptate (pseudoseptum),** ซูโดเซบเตต | สปอร์ที่มีหยดน้ำมันด้านหัวและท้าย หรือมีเยื่อภายใน ทำให้ดูคล้ายมีผนังกั้น |
| **Pseudostroma**, ซูโดสโตรมา | โครงสร้างที่เกิดจากเส้นใยหรือเนื้อเยื่อของราที่รวมกับเนื้อไม้ทำหน้าที่ในการสร้างโครงสร้างสืบพันธุ์แบบอาศัยเพศและไม่อาศัยเพศ |
| **Pubescent, *ขนสั้นนุ่ม*** | ขนสั้นนุ่ม |
| **Punctiform, *เป็นจุด*** | เป็นจุด |
| **Pustule**[130], ***ตุ่ม*** | ตุ่ม |
| **Pycnidiospore**[131], ***พิคนิดิโอสปอร์*** | ดู conidia |
| **Pycnidium**[132] **(pl. pycnidia),** ***พิคนิเดียม*** | โครงสร้างสืบพันธุ์แบบไม่อาศัยเพศ ลักษณะคล้ายเพอริทีเซียแต่ฝังจมอยู่ในแทลลัส |
| **Pyrenium** (of perithecia) | ผนังของเพอริทีเซีย |
| **Pyrenocarp** (perithecium), ไพรีโนคาร์ป | ดู Perithecia |

118. perithecia



119. phycobiont



120. phyllidia

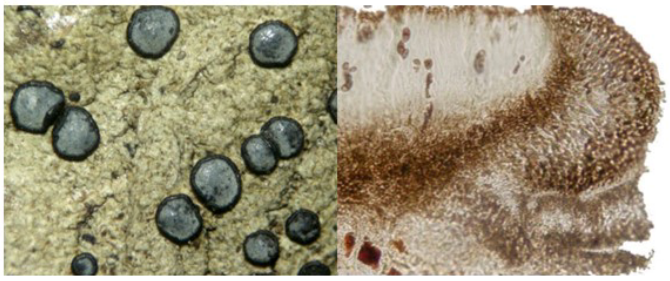
121. placoid

122. plicate

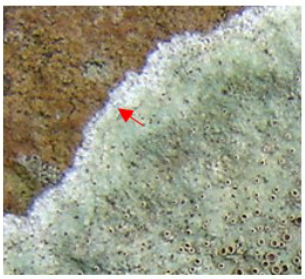
123. podetia

124. polarilocular

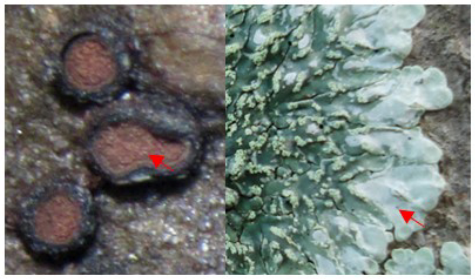
125. primary thallus



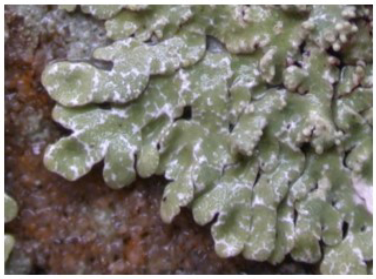
126. proper exciple



127. prothallus



128. pruina



129. pseudocyphellae

| | |
|---|---|
| Pyrenolichen | กลุ่มไลเคนที่สร้างเพอริทีเชีย |
| Pyriform (of spores, perithecia) | สปอร์หรือเพอริทีเชียรูปชมพู่ |
| Radiate[133], - ***แผ่ตามรัศมี*** | แทลลัสที่แผ่ตามรัศมี/แผ่เป็นรัศมี |
| Rugulose, ***ย่นละเอียด*** | ย่นละเอียด |
| Reniform, - ***รูปไต*** | รูปไต |
| Reticulate[134], ***แบบร่างแห*** | แบบร่างแห |
| Revolute, - ***(ขอบ) ม้วนลง*** | ม้วนลง |
| Rhizine[135] (rhizoid), ***คล้ายราก/ไรซีน, ไรซอยด์*** | เป็นส่วนของเส้นใยราที่รวมตัวกัน เกิดเป็นรูปร่างหลายแบบ ทำหน้าที่คล้ายราก (rhizoid) ยึดเกาะกับที่อยู่อาศัย |
| Rhizohyphae | เส้นใยราเดี่ยว ๆ ที่ทำหน้าที่ยึดเกาะของไลเคนบางชนิด เช่น สกุล *Catapyrenium* |
| Rimose (of thallus) | รอยแตกขนาดเล็กแบบไม่สม่ำเสมอของแทลลัส |
| Rod-shape (pycnidiospore) | รูปท่อน |
| Roll, ม้วน | ม้วน |
| Rosette-shaped (of thallus) | เรียงซ้อนกันแบบกลีบกุหลาบ รูปร่างกลม หรือสมมาตร |
| Rotate, - ***รูปกงล้อ*** | หมุนเป็นวง |
| Rotund, - ***เกือบกลม*** | เป็นวงกลม ค่อนข้างกลม |
| Saddle-shaped (of apothecia) | แอโพทีเชียที่มีลักษณะยาวและโค้ง คล้ายอานม้า เช่น ไลเคนสกุล *Peltigera* |
| Saxicolous lichen[136], ไลเคนบนหิน | ไลเคนที่เจริญเติบโต และเกาะอาศัยอยู่บนหิน |
| Scabrose (of thallus surface) | ผิวแทลลัสที่ขรุขระ เกิดจากการตายสะสมของเส้นใยราในชั้นคอร์เทกซ์ |
| Schizidia[137] | โครงสร้างสืบพันธุ์แบบไม่อาศัยเพศของไลเคน มีลักษณะเป็นแผ่นแบนราบถึงโค้งนูน คล้ายสะเก็ดที่ผิวบนแทลลัส |
| Secondary metabolite, -สารเมเทบอไลท์ทุติยภูมิ | สารอินทรีย์ทุติยภูมิที่ราในไลเคนสร้างขึ้น และสะสมอยู่ที่ผิวของเส้นใยรา |
| Septate[138], - ***มีผนังกั้น***, - แบ่งโดยผนังกั้น | ผนังกั้นระหว่างเซลล์ เช่น ผนังกั้นสปอร์ |
| Septum (pl. septa), ***ผนังกั้น*** | ผนังกั้น |
| Serrate, ***จักฟันเลื่อย*** | ลักษณะขอบแทลลัสหรือแอโพทีเชีย คล้ายฟันเลื่อย |
| Sessile, - ***ไร้ก้าน*** | ลักษณะของแอโพทีเชียที่ติดบนผิวของแทลลัสโดยไม่มีก้านชู |
| Sigmoid, - ***คล้ายตัวเอส*** | รูปร่างคล้ายอักษร S เช่น รูปร่างสปอร์ |

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| Sinuate, ***เว้าเป็นคลื่น*** | ลักษณะขอบแทลลัสที่เว้าเป็นคลื่น |
| Smooth, ราบเรียบ | ลักษณะผิวเรียบพบได้ในแทลลัสหรือสปอร์ |
| Solid, ของแข็ง, ทรงตัน | ทรงตัน |
| Soralium (pl. soralia), ซอราเลียม | บริเวณของแทลลัสที่สร้างกลุ่มของซอรีเดีย (ดู soredia) |
| Soredia[139] (sing. soredium), ซอรีเดีย | ลักษณะคล้ายฝุ่นผงหรือขนมถ้วยฟู เกิดจากการแตกของคอร์เทกซ์ ซอรีเดียประกอบด้วย กลุ่มของสาหร่ายที่ห่อหุ้มด้วยเส้นใยรา โดยซอรีเดีย มีรูปร่างหลายแบบรวมกันอยู่เป็นกลุ่ม เรียก soralia |
| Spermogonia (sing. spermogonium) | เส้นใยราที่แตกแขนงเป็นจำนวนมาก อยู่ภายในพิคนิเดีย ทำหน้าที่เป็นโครงสร้างสืบพันธุ์แบบไม่อาศัยเพศ เรียกว่า โคนิเดีย |
| Spinule, ***หนามละเอียด*** | หนามละเอียด |
| Spore, ***สปอร์*** | เซลล์สืบพันธุ์แบบอาศัยเพศ และไม่อาศัยเพศ |
| Spot tests[140], ทดสอบจุดสี | วิธีการตรวจหาสารธรรมชาติของไลเคนเบื้องต้น ด้วยการหยดสารเคมีบางชนิดลงบนส่วนต่าง ๆ ของไลเคนทำให้เกิดสีต่าง ๆ ซึ่งขึ้นอยู่กับชนิดของสารที่มีในไลเคน |
| Squamule[141], ***เกล็ด*** | โครงสร้างของแทลลัสที่มีลักษณะเป็นใบเกล็ดขนาดเล็ก |
| Squamulose, - ***มีเกล็ด*** | มีเกล็ด |
| Squarrose, ***กางออก*** | กางออก |
| Stipitate (of apothecia) | มีก้าน แอโพทีเชียที่มีก้าน |
| Striate[142], ***มีริ้ว*** | ริ้วรอยตามแนวยาว พบบนแอโพทีเชียของไลเคนบางชนิด เช่น Graphidaceae |
| Stroma[143], สโตรมา | กลุ่มเส้นใยราที่เจริญอัดตัวกันแน่น ล้อมรอบแอโพทีเชียหรือเพอริทีเชีย |
| Subcuticular, ใต้หนังกำพร้า, ใต้ผิว | แทลลัสบางส่วนเติบโตใต้ผิวใบ |
| Subglobose[144], เกือบเป็นทรงกลม | เกือบเป็นรูปทรงคล้ายลูกโลก เกือบกลมหรือกึ่งกลม |
| Subhymenium, ใต้ชั้นไฮเมเนียม | ดู hypothecium |
| Submuriform[145], กึ่งมูริฟอร์ม | สปอร์ที่คล้ายมูริฟอร์มมีผนังกั้นตามขวางหลายผนัง แต่มีผนังกั้นตามยาวเพียง 1 ถึง 2 ผนัง |
| Subrotund, เกือบเป็นลูกกลม | เกือบเป็นวงกลม |
| Substrate, ***ที่ซึ่งสิ่งมีชีวิตขึ้น*** | พื้นผิวที่สิ่งมีชีวิตเกาะอาศัย |
| Subulate[146], - ***รูปลิ่มแคบ*** | ท่อกลมฐานกว้างปลายแคบ |
| Sulcate, - ***เป็นร่องตามยาว*** | ส่วนบนของชั้นเอกซิเปิลแยกเป็นริ้ว |
| Supracuticle, บนผิว | แทลลัสบางส่วนเติบโตบนผิวใบไม้ |

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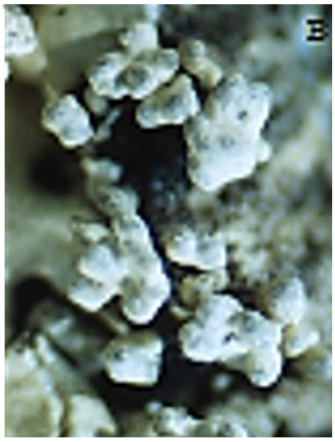
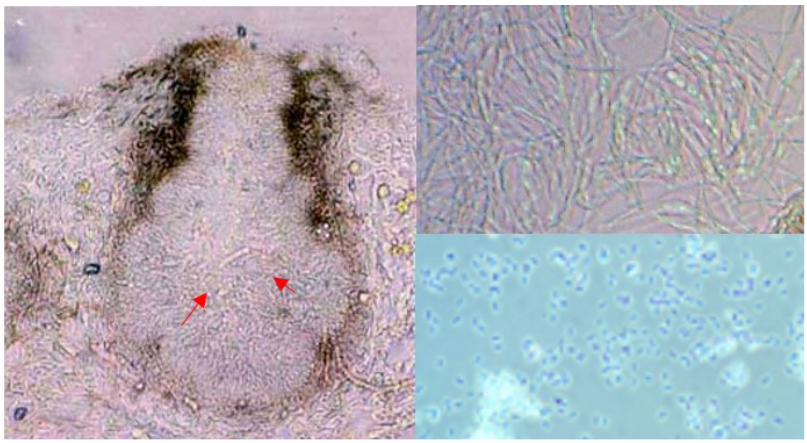
| **Symbiosis (mutualism),** ภาวะอยู่ร่วมกัน | ภาวะอยู่ร่วมกันของราและสาหร่ายที่ต่างฝ่ายต่างอำนวยประโยชน์ให้กันและกัน |
| **Sympodial,** ซิมโพเดียล | เจริญออกทางด้านข้าง |
| **Taper,** ชิ้นปลายสอบ | ปลายสอบ |
| **Terete,** - ***คล้ายทรงกระบอก*** | คล้ายทรงกระบอก |
| **Terricolous,** บนดิน | เจริญบนดิน |
| **Tetrachotomous** (of thallus parts) | การแตกเป็น 4 กิ่งของแทลลัส |
| **Thalline exciple**[147] | เอกซิเปิลมีสาหร่าย |
| **Thalloconidia** (of thallus parts) | โครงสร้างสืบพันธุ์แบบไม่อาศัยเพศของราสหชีพ มีลักษณะกลมขนาดเล็ก เกิดจากกลุ่มของเส้นใยรา |
| **Thallus,** แทลลัส | โครงสร้างร่างกายไลเคน ซึ่งเป็นจุดกำเนิดของโครงสร้างส่วนอื่น ๆ เช่น แอโพทีเซีย เพอริทีเซีย ไอซิเดีย และพิคนิเดีย เป็นต้น |
| **Thecium** (of ascocarps) | (ดู hymenium) |
| **Thin layer chromatography (tlc)**[148], โครมาโทกราฟีแผ่นบาง, รงขเลขผิวบาง | เทคนิคที่ใช้แยกสารประกอบหลายชนิดออกจากกัน โดยอาศัยความแตกต่างของน้ำหนักโมเลกุลของสารที่ต่างกันเคลื่อนผ่านตัวดูดซับ เช่น ซิลิกา (silica) ที่เคลือบบนแผ่นแก้วหรือแผ่นอลูมิเนียมได้แตกต่างกัน (ดู Chromatography ประกอบ) |
| **Tholus** | (ดู apical dome) |
| **Tomentum**[149], ***ขนยาวนุ่ม*** | ขนยาวนุ่ม เป็นชั้นของผิวล่างของโฟลิโอสไลเคนที่มีลักษณะคล้ายแผ่นสำลี หรือสก๊อตซ์ไบร์ท เกิดจากเซลล์ที่ชั้นคอร์เทกซ์ เติบโตและพัฒนาคล้ายขน รวมตัวกันเป็นกระจุก มีสีต่าง ๆ กัน ตั้งแต่สีน้ำตาลอ่อนจนถึงสีดำ |
| **Torus**[150] (of spores) | บริเวณที่มีสีเข้มโดยรอบผนังกั้นของสปอร์ในสกุล *Rinodina* |
| **Translucent,** ***โปร่งแสง*** | โปร่งแสง |
| **Trans-septate,** - ผนังกั้นตามขวาง | ผนังกั้นตามขวาง |
| **Trichotomous** (of thallus parts) | การแตกออกเป็น 3 กิ่งของแทลลัส |
| **Truncate,** ***ตัดปลาย***, - ***ปลายตัด*** | ปลายตัด |
| **Tubercle,** ***ปุ่ม***, หัวย่อย | ปุ่ม (สกุล *Usnea*) |
| **Ultraviolet**[151], อัลตราไวโอเลต/แสงเหนือม่วง | แสงเหนือม่วงใช้ทดสอบการเรืองแสงของไลเคน |
| **Umbilicate,** ***ช่อซี่ร่มเว้ากลาง***, **คล้ายร่ม** | แทลลัสมีลักษณะคล้ายร่ม และมีส่วนยึด (holdfast) ตรงกลางแทลลัสติดกับที่อยู่อาศัย |



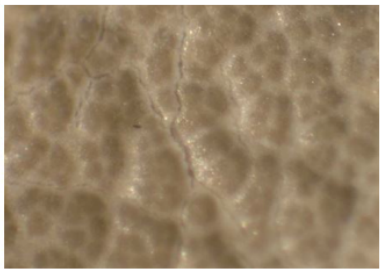
130. pustule



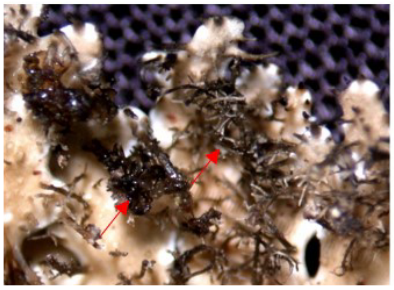
131. pycnidiospore

132. pycnidium

133. radiate



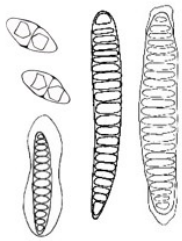
134. reticulate



135. rhizine

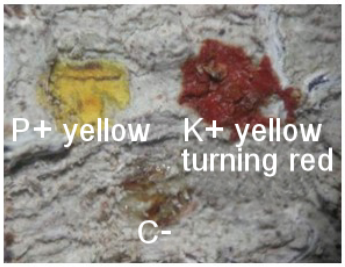
136. saxicolous lichen

137. schizidia



138. septate (ascospores)

139. soredia




140. spot tests

141. squamule

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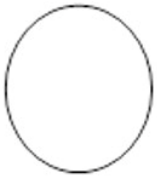
|---|---|
| **Umbonate** (of apothecia) | แอโพทีเชียที่มีกลุ่มเส้นใยราที่เป็นหมันอยู่รวมกันเป็นแท่ง ยื่นโผล่ออกมาจากชั้นไฮเมเนียม ทำให้มีลักษณะเป็นตุ่มก้อนอยู่ตรงกลาง เช่น ไลเคน *Lecidea umbonata* |
| **Undulate**, - ***เป็นคลื่น*** | เป็นคลื่น |
| **Uniseriate**[152], - ***เรียงแถวเดียว*** | เรียงเป็นแถวเดียว |
| **Unitunicate** | มีผนังชั้นเดียว |
| **Urceolate**, - ***รูปคนโท***, - ***รูปโถ*** | รูปร่างคล้ายคนโทมีโพรงข้างใน |
| **Vein**[153], ***เส้นใย คล้ายเส้นใย*** | เส้นนูนคล้ายเส้นใย พบด้านบนของสกุล *Lobaria* |
| **Verrucose**, ***เป็นตุ่มหูด*** | ลักษณะผิวแทลลัสแบบขรุขระอย่างหยาบ |
| **Verruculose**, เป็นตุ่มหูดละเอียด | ลักษณะผิวแทลลัสแบบขรุขระอย่างละเอียด |
| **Wax**, ***ไข*** | ไข |
| **Wrinkle**, ยับย่น | ลักษณะยับย่น |
| **Xeric**, - ***แห้งแล้ง*** | สภาวะที่แห้งแล้ง |
| **Zeorine**, ซีออริน | สารอินทรีย์ทุติยภูมิชนิดหนึ่งที่ไลเคนสร้างขึ้น |
| **Zonate** (of thallus) | แทลลัสที่สีแตกต่างกัน มีลักษณะเป็นแถบหรือวง เช่น ไลเคน *Pertusaria amara* |

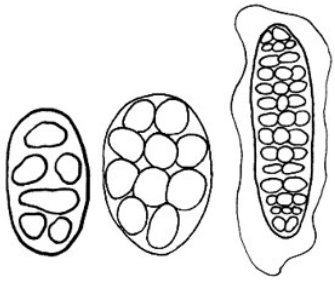
142. striate



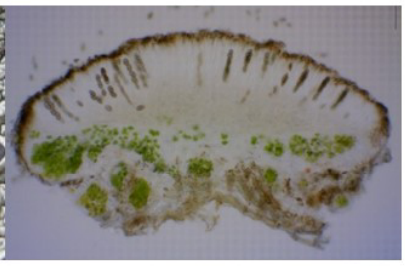
144. subglobose

146. subulate

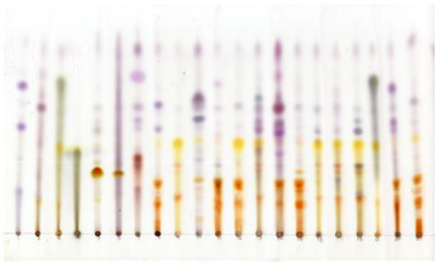
143. stroma



145. submuriform



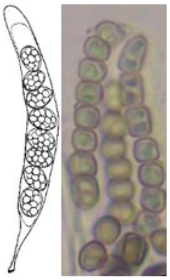
147. thalline exciple



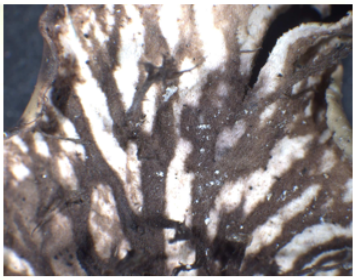
148. thin layer cromatography

149. tomentum

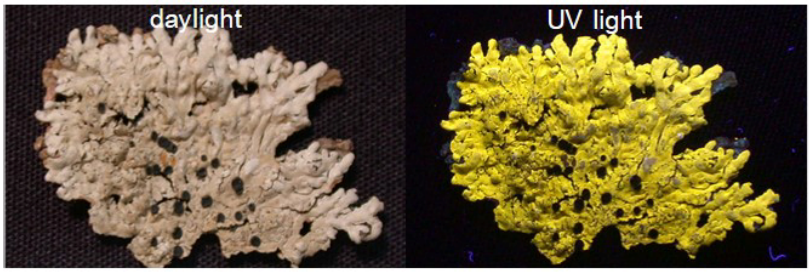
150. torus



152. uniseriate



153. vein




151. ultraviolet

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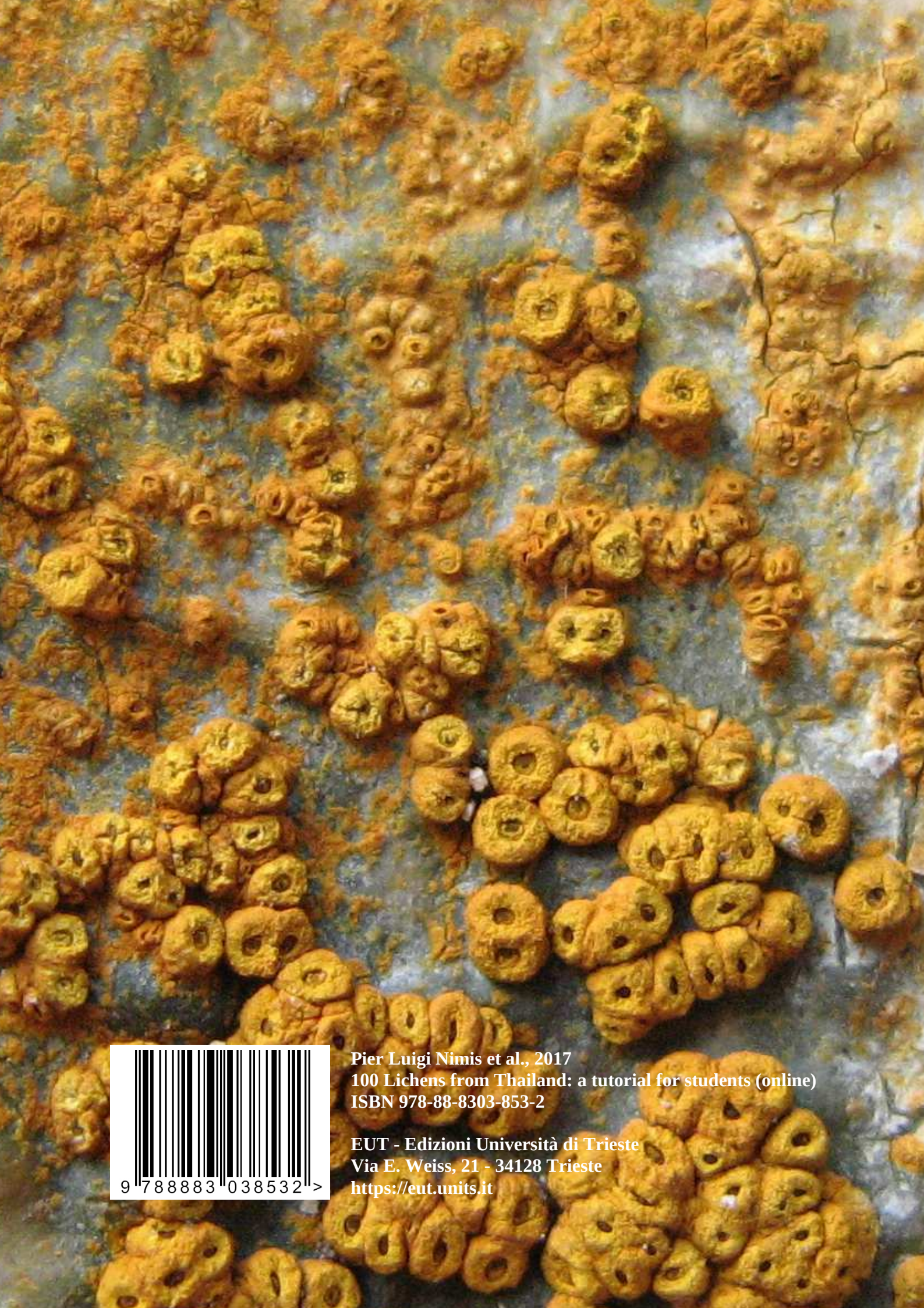

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